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Congressional Testimony on Climate Change (Other) [1]

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Testimony

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

'97 NOV 12 PM 4:47

TRANSMISSION NUMBER: 202/395-5836
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	Name	Fax #
To:	<u>Todd Stern</u>	<u>X 62215</u>
	<u>David Sandalow</u>	<u>X 62710</u>
	<u>Peter Orszag</u>	<u>X 62223</u>
From:	<u>Bob Tuccillo</u>	
Message:	<u>Draft Wirth testimony for tomorrow's hearing.</u>	
	<u>Please let me know by <u>5:30</u> today if you have</u>	
	<u>comments</u>	

Number of Pages to Follow: 2

Date: 11/12/97

Time: 4:30 pm

Statement By
Under Secretary for Global Affairs Timothy E. Wirth
House Committee on International Relations
November 13, 1997

Thank you for this opportunity to inform your committee about the status of the international climate change negotiations. The U.S. delegation finished its work two weeks ago at the eighth session of the Ad Hoc Group on the Berlin Mandate (AGBM) and what was to have been the last formal "pre-negotiation meeting" prior to the meeting of the Third Conference of the Parties (COP-3) in Kyoto. Because further preparatory work remains, governments will reconvene for a half day on November 30 and a half day on December 1 before COP-3 begins on the afternoon of December 1.

President Clinton's announcement of the U.S. target on October 22 changed the dynamic of the negotiations. His speech marked the beginning of a new initiative to undertake realistic and achievable efforts to reduce greenhouse gas emissions. In his speech, the President outlined a flexible, market-based and cost-effective approach, backed by a comprehensive domestic program to help meet the ambitious target to return greenhouse gas emissions to 1990 levels in a budget period between 2008 and 2012. This target will be followed by a reduction below 1990 levels in the five-year period thereafter, and an effort to make further reductions in the years beyond that. Unlike the EU and others' proposals, the U.S. plan takes a comprehensive view with regard to the gases to be included. We are prepared to address a broad range that includes the extremely potent greenhouse gases such as HFCs, PFCs, SF6 and all land use and forest sinks. In real terms, the U.S. commitment is the equivalent of cutting greenhouse gas emissions by 23 percent below where they would otherwise be in 2010.

A major element of the President's proposal is the call for both industrialized and developing countries to participate in meeting the challenge of climate change. While developed countries must lead, he stated that key developing nations must meaningfully participate; otherwise, the United States will not assume binding obligations. Their involvement is vital to addressing the global problem we face. These nations have an opportunity to chart a different energy future.

The President also placed great emphasis on the need to rely on a series of flexible mechanisms for achieving binding limits and lowering costs. Innovations such as emissions trading and joint implementation with credit can cut worldwide pollution and help developing countries protect their own environments without sacrificing economic growth.

Our negotiators worked with other delegates at the Bonn meeting to develop the text for a protocol or other legal instrument for consideration at COP-3 that is consistent with the U.S. proposal. Although we saw movement in some areas critical to the overall U.S. position, most important issues within the text remain bracketed and are far from agreed. These include sections on emissions trading, joint implementation, commitments by

developing countries, harmonized policies and measures, multi-year emissions budgets, the treatment of carbon sinks, and the level of target reductions of greenhouse gas emissions by Annex I countries.

Reaching consensus with other negotiating Parties on these issues has been and will continue to be a difficult task: the Group of 77 countries and China worked to block the text in several areas and reintroduced text to reflect its insistence that there be no new commitments from developing countries, and to obtain new concessions from developed countries on financing and the transfer of "climate-friendly" technologies. Thus, with less than one month until the Conference of the Parties at Kyoto, much work needs to be done on many outstanding and difficult issues.

Last week, I met with Environment Ministers from the European Union "Troika." It was a constructive meeting, and I believe that our dialogue served to further understanding of our respective approaches. We have committed to undertaking intense consultations with the EU over the coming weeks.

NEW
I also went to Japan over the weekend to lead a U.S. delegation to an informal meeting at the ministerial level in Tokyo. That session provided an opportunity to meet with our EU colleagues again, as well as ministers from other Annex I and non-Annex I Parties. The session provided the first opportunity for most ministers to hear for themselves each other's concerns -- and as such was enormously helpful. We continue to find areas of common ground with our developed country partners, including on such elements as the budget period (where we agree on a five year duration) and on the long term need to involve all sources and sinks of all gases and all sectors, and to fully engage developing countries. While modalities for achieving these have not been resolved, I am confident that it will be possible to do so within the remaining time before the end of the Kyoto session.

Unfortunately, some of the key developing countries did not attend the ministerial in Tokyo (China, India and Saudi Arabia were each invited but did not come). In spite of the unencouraging turnout, we did find some flexibility from developing country attendees (including Argentina, Brazil, Indonesia, Korea, Mexico, Samoa -- representing the Alliance of Small Island States and Tanzania -- representing the entire Group of 77 and China). However, while some elements of progress could be ascertained from delegates that did participate, we cannot be certain this movement reflects a broader agreement that might emerge in Kyoto.

Initiated in January of this year, U.S. policy on climate change became fully fleshed out with President Clinton's announcement of the U.S. target last month. Kyoto marks the next step in a series of steps that will enable the United States and all nations to fulfill the Climate Convention's ultimate objective. It will not be an easy road to Kyoto, but through an intensive, comprehensive diplomatic effort, we will increase our chances for success considerably.

Testimony

UNITED STATES DEPARTMENT OF STATE
WASHINGTON, D.C. 20520

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FAX COVER SHEET

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**United States Department of State***Washington, D.C. 20520***Statement of Under Secretary Timothy E. Wirth**

Q. What will be the Congressional role in Kyoto?

A. The Administration supports the participation of congressional observers at the Kyoto Conference from both the House and the Senate. We continue to value and seek out the advice and counsel of Members of Congress in formulating our policy.

- To ensure access to the conference facility, Members and staff will be included in the official U.S. Delegation for purposes of accreditation.
- Congressional observers on the U.S. Delegation are of course free to express their views and opinions to the press, so long as they make clear that they are not speaking on behalf of the U.S. Delegation.
- However, unlike Executive Branch officials who are responsible for negotiating on behalf of the United States, the role of Congressional Observers will not include speaking on behalf of the United States Delegation in negotiating sessions or with foreign delegations.
- Congressional observers will have full diplomatic support. The State Department will assign staff to assist Members of Congress and their staff to ensure that their administrative needs in Kyoto are met. Additionally, Department staff, both here and in Japan, have begun and will continue to assist Congressional staff in planning other meetings and activities to make their participation as productive as possible.

- Consistent with the rules of the Conference, space availability, and our negotiating needs, we will seek access for observers to appropriate Conference proceedings.
- Congressional observers and their staffs are welcome to attend meetings of the full U.S. delegation, which customarily occur in the morning. Observers will also receive regular and frequent briefings in Kyoto. Additionally, they will be welcome to attend other meetings of the Delegation as appropriate and consistent with Executive Branch responsibilities.

Testimony

97 NOV 12 4:46E

ORRIN G. HATCH, UTAH, CHAIRMAN

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United States Senate

COMMITTEE ON THE JUDICIARY

WASHINGTON, DC 20510-6275

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CALL (202) 224-7703 IMMEDIATELY IF YOU HAVE ANY QUESTIONS.

Date: Nov. 12, 1997
To: Todd Stern
From: Ed Barron, Senate Judiciary
Subject: Full Senate Agriculture Committee Hearing Tomorrow
On Global Climate Change

Please call me at 224-7703 (or 224-0002, private line) or FAX to 224-9516, if you would recommend any changes to the attached draft statement for Senator Leahy.

The former C.I.A. Director, James Woolsey, will testify.

I worked with Senator Leahy in including an entire title to the 1990 farm bill on "Global Climate Change." The Senator will be very supportive of the W.H.

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**Statement of Senator Patrick Leahy
Global Climate Change**

When I was Chairman I was pleased that this Committee included a "Global Climate Change" title in the 1990 farm bill.

That title called for careful monitoring of the effects of global climate change on agriculture and forestry.

Senator Lugar and I worked together on that provision as well as the bill as a whole. As I said then, global climate changes could have a massive impact on our ability to grow food and feed the world.

Americans are lucky in that we now grow to feed the world.

However, I worry about future generations -- not necessarily my children, but perhaps my childrens' children could be forced to deal

with a world where it is much harder to grow crops and where millions are desperately hungry.

Mr. Chairman, I think the President is very right to be concerned about the future, as are you.

Human activities are changing the climate of the earth. Concentrations of greenhouse gases in the atmosphere are at their highest levels and climbing sharply.

If this trend is not stopped some scientists expect the seas to rise two feet or more in the next century -- this could flood 9,000 square miles of Florida, Louisiana and other coastal areas.

I am not as worried about Vermont -- in terms of the flooding issue. There a number of weather anomalies that have scientists worried.

The incidence of observed tornadoes in the U.S. is up dramatically, and if it gets any hotter in Washington in the summer I am going to introduce a bill to move the U.S. Capitol to the Northeast Kingdom in Vermont.

I am worried about the ability of the world to feed itself as this trend continues.

In addition, studies show that malaria and other diseases are spreading to new areas because of warmer conditions. Stories in the *New England Journal of Medicine*, *America Scientist* magazine, *Science*, and the *New Scientist* detail these concerns and many suggest that disease is one of the deadliest threats of global warming.

Some argue that America should not do its part in reducing emissions because other countries won't do their share.

There are a couple problems with this attitude. First, the United States emits about 20 percent of the total greenhouse gases in the world.

Second, if we do not act there is little chance that the rest of the world will. The new millennium is almost here and we should focus on the longer term.

A report just issued by CRS describes the negative far reaching effects of global warming on agriculture and forestry. The President wants the U.S. to reduce its greenhouse gas emissions by 8.3% by the year 2012.

I applaud the President for his efforts, and you for holding this hearing.

News Release

***Senate Agriculture, Nutrition and Forestry Committee
Chairman Dick Lugar, U.S. Senator for Indiana***

Contact: Jennifer Cutshall 202-224-7438

Date: 11/3/97

**FORMER CIA DIRECTOR TO TESTIFY BEFORE AG COMMITTEE
ON ENERGY SECURITY AND GLOBAL-WARMING**

WASHINGTON -- U.S. Senator Dick Lugar today announced a Senate Agriculture Committee hearing to examine ways renewable fuels could aid in decreasing greenhouse gas emissions and increasing U.S. energy security. The former Director of the Central Intelligence Agency, R. James Woolsey, will testify.

The hearing, which will take place **Thursday, November 13 at 9 a.m. in SR-328A**, will focus on specific ways that the United States may take a lead in developing fuels that are less damaging to the environment than the current fossil fuels. In advance of the December environmental summit in Kyoto, Japan, the hearing will provide committee members an opportunity to examine the role of agriculture in creating alternative energy resources and the serious environmental, economic and political problems associated with continued U.S. dependence on foreign oil. The Kyoto summit will bring representatives of more than 150 nations together to discuss climate change and negotiate binding targets for emission levels of carbon dioxide gas and other greenhouse gases. European Union countries are sending environmental officials to Washington tomorrow to discuss emission levels in advance of the Kyoto summit. The U.S. is currently the leading contributor of greenhouse gases.

Lugar has long been a proponent of ag-based fuels as a means of achieving greater U.S. energy security while also benefitting the environment. Last week, the Senate passed legislation introduced by Lugar which provides \$780 million in funding for research in critical emerging areas of agriculture, such as the development of new and alternative energy uses for agricultural commodities. Lugar called passage of the legislation an important step in meeting the needs of a world population expected to double during the next 50 years.

"As a growing, and increasingly wealthy, population attempts to meet its food and energy needs, it is critical that the world's rain forests and other ecologically crucial areas are not desperately uprooted for use as farmland and fuel sources," said Lugar, Chairman of the Senate Agriculture, Nutrition and Forestry Committee. **"While food and energy are critical to survival, the long-term impact of destroying environmentally important areas is devastating. Agricultural research is an important step in meeting increasing needs, but doing so on current arable land."**

In a recent Wall Street Journal editorial, former CIA director Woolsey outlined specific alternatives to oil that would lead to improved air quality and greater energy independence. During next week's hearing he will be asked to elaborate on his findings.

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10/24/97 WSJ A22

10/24/97 Wall St. J. A22

1997 WL-WSJ 14171226

(Publication page references are not available for this document.)

The Wall Street Journal
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Friday, October 24, 1997

Alcohol and Driving Can Mix
By R. James Woolsey

President Clinton's global-warming proposal includes some \$5 billion in tax breaks to encourage the development of new technologies to curb carbon dioxide emissions. But promising technologies may already be in the offing. New microbes and biocatalysts with names like *zymomonas mobilis* and KO-11 have been genetically engineered to produce ethyl alcohol not just from feed grains but also from other plants and common organic wastes. The production of ethyl alcohol from biomass may turn out to be as revolutionary as the production of integrated circuits from silicon, vastly affecting the world's distribution of wealth and the fundamentals of international security.

Replacing gasoline with biomass-derived ethyl alcohol would greatly reduce man-made greenhouse-gas emissions -- estimates put carbon dioxide emissions at 1/10th or less than those for gasoline over the life cycle of fuel production and use. Other changes in transportation would be far more costly: Fuel-cell cars, for example, would require retooling Detroit's factories; other efforts would need a vast new infrastructure for fuel distribution; and a major shift toward mass transit seems implausible in many of today's fast-growing, sprawling cities.

In contrast, very little such new investment would be necessary for ethyl alcohol to become a major share of transportation fuel. Older cars' engines are able to burn gasohol (10% ethyl alcohol); and a computer chip in the fuel systems of this year's midsize Ford and Chrysler minivans permits the use of up to 85% alcohol. Federal fuel economy standards encourage these new "flexible fuel vehicles," and they have fortuitously arrived just as the new technology is ready to reduce alcohol costs. Mixing these fuels with gasoline is now done easily at filling stations that sell gasohol. Environmental costs go down with alcohol: its wide use would lead to a substantial improvement in air quality. And an alcohol spill on an Alaskan shore would produce

nothing worse than dispersal, evaporation and possibly some inebriated seals.

The one real barrier to ethyl alcohol's replacing a large share of gasoline is production cost, which today is comparatively high and volatile. Alcohol's current feedstock, corn, is subject to the caroming behavior of feed markets. In 1995 its price, normally around \$100 a ton, nearly doubled, and the production of alcohol for transportation consequently had to be cut by a third. Ethyl alcohol feedstocks have been limited because the yeast that has been used for millennia in fermentation can only convert food crops. But advanced biocatalysts and genetically engineered microbes now make possible the cost-effective conversion of cellulose: grass, trees and biomass waste.

Even at today's fossil fuel prices, it is likely that as ethyl alcohol's cost declines it will come to be used as the emission-reducing oxygenate that is added to gasoline. But the key issue is whether alcohol derived from biomass can become cheap enough to begin to replace gasoline. Over the past 15 years the cost of producing a gallon of alcohol from corn has been cut in half, to about \$1 a gallon. If the new technology were to make it possible for costs to fall another 30 to 40 cents, alcohol would become competitive with gasoline when oil reaches around \$25 a barrel.

Is such a reduction in cost plausible? Consider switch grass, common on the prairie. The U.S. Department of Energy estimates twice as much alcohol could be produced per acre from it than from corn. Since switch grass requires almost no tilling, planting, fertilizing or other use of fuel or chemicals, using it as a feedstock would yield several times more energy than would be consumed during production -- far better than with either gasoline or corn-derived alcohol. Switch grass and many biomass crops enrich the soil instead of depleting it. Vastly more of the earth's surface is available to grow such grasses, fast-growing trees and aquatic vegetation than is available for feed grains. For example, thinning forests by removing underbrush and small trees reduces forest fires and preserves wildlife habitat -- and some cousin of *zymomonas* would doubtless love to dine on such scrap brush.

10/24/97 WSJ A22

(Publication page references are not available for this document.)

Will oil prices hit \$25 a barrel in a few years, making it possible for even unsubsidized alcohol to replace a large share of gasoline? The Energy Department forecasts a flat market, but the oil bulls have a strong case because of perennial instability in the Mideast and because demand will burgeon as a growing share of the growing population in Asia moves into cities. Fortune magazine noted two years ago that once China's and India's energy consumption per capita reach South Korea's current level, these two countries alone will need almost 120 million barrels of oil a day -- nearly double what the world uses today. In spite of oil discoveries elsewhere, it is likely that at least three-fourths of any new demand will be filled from the huge reserves of the Mideast, transferring more than \$1 trillion over the next 15 years to the autocratic (and worse) states of the unstable Persian Gulf alone, in addition to the annual \$90 billion they receive today.

Thus, if genetically engineered microbes and advanced biocatalysts can start a transition from fossil fuels to biofuels, a major Middle East war involving the U.S. would become less likely. We would become freer to support democracies and our friends -- Israel, Turkey, Jordan -- without weighing whether we might offend an oil state. At the same time, subsistence farmers in Africa and Latin America, paid to grow transportation fuel, would begin to climb out of poverty; Ukraine, rich in fertile land, would become more independent of oil-rich Russia; China would feel less pressure to befriend Iran and to build a big navy to dominate the oil-rich South China Sea.

What's more, new markets for biofuel crops would help rural America to prosper; substantial improvements in air quality would let EPA Administrator Carol Browner stop worrying about our power lawnmowers and let Detroit produce four-wheel-drive sports vehicles to its heart's content; and the U.S. trade deficit would shrink substantially, reducing Wall Street's propensity to panic whenever the Japanese prime minister gets grumpy about holding U.S. debt.

Who would lose? Chiefly oil-exporting states. But many others would need an attitude check: oil

companies, if they resist diversifying; bureaucrats who don't like flexible-fuel vehicles, because they aren't subsidized in their particular fiefdom; environmentalists who don't like them either, because they permit Detroit to build larger cars (the more they burn alcohol, folks, the less you should care); Archer Daniels Midland, which will have to get used to losing its near-monopoly of the ethanol market; and of course Roger Tamraz, because struggles over pipeline routes will become boring.

What would we need to do before the December

Kyoto summit? Just announce that, in view of biofuels' advantages, we are going to use government purchases and policies to help give them a stable market until early in the next century while production gears up, somewhat as we did with silicon chips. We might even add that, except for continuing to do basic research and development, we plan to phase out all energy subsidies (including oil's remaining foreign tax credit) toward the end of that period.

Then we could stand back, and let the new bugs and the market do the rest.

Mr. Woolsey, an attorney in Washington, was director of central intelligence, 1993-95.

--- INDEX REFERENCES ---

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REGION: North America; United States (NME US)

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10/24/97 WSJ A22

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11/12/97 WED 10:20 FAX 202 224 9510 CS SEN JED CME 2/010

Date: November 12, 1997
To: Senator Leahy
From: Ed Barron
Subject: Global Climate Change/Alternative Fuels Hearing

The full Agriculture Committee hearing starts at 9:00 a.m.

The hearing provides a great opportunity for you to showcase your early leadership role on this issue. You insisted on including a "Global Climate Change" title in the 1990 farm bill - which forced America to confront these issues -- and turns out in have been very prescient.

Also, the hearing presents a good opportunity for you to support the President's efforts [and Todd Stern's efforts] on global warming prior to the December 1 though December 10 meetings in Kyoto, Japan.

[Yes, or should I say "hai," I can pack my bags at a moment's notice! My five courses in Japanese language will come in very handy. Sayonara.]

The witnesses are:

Mr. James Woolsey, former C.I.A. Director
Mr. Reid Detchon, Biomass Energy Advocates

Senator Lugar will support the use of alternative fuels to reduce greenhouse gas emissions and talk about Kyoto. His press release talks about how the hearing:

in advance of the environmental summit in Kyoto, Japan, will examine the role of agriculture in creating alternative energy resources It is critical that the world's rain forests and other ecologically crucial areas are not desperately uprooted for use as farmland and fuel sources.

Attached is a *Wall Street Journal* article by James Woolsey entitled "Alcohol and Driving Can Mix."

Also, two charts are attached. Your book tomorrow will have the color versions of them if you want to use them.

Today's *Washington Post* has two full pages on these issues.

Testimony

'97 NOV 12 PM 4:46

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News Release**Senate Agriculture, Nutrition and Forestry Committee
Chairman Dick Lugar, U.S. Senator for Indiana**

Date: 11/3/97

Contact: Jennifer Cutshall 202-224-7438

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 By R. James Woolsey

President Clinton's global-warming proposal includes some \$5 billion in tax breaks to encourage the development of new technologies to curb carbon dioxide emissions. But promising technologies may already be in the offing. New microbes and biocatalysts with names like *zymomonas mobilis* and KO-11 have been genetically engineered to produce ethyl alcohol not just from feed grains but also from other plants and common organic wastes. The production of ethyl alcohol from biomass may turn out to be as revolutionary as the production of integrated circuits from silicon, vastly affecting the world's distribution of wealth and the fundamentals of international security.

Replacing gasoline with biomass-derived ethyl alcohol would greatly reduce man-made greenhouse-gas emissions -- estimates put carbon dioxide emissions at 1/10th or less than those for gasoline over the life cycle of fuel production and use. Other changes in transportation would be far more costly: Fuel-cell cars, for example, would require retooling Detroit's factories; other efforts would need a vast new infrastructure for fuel distribution; and a major shift toward mass transit seems implausible in many of today's fast-growing, sprawling cities.

In contrast, very little such new investment would be necessary for ethyl alcohol to become a major share of transportation fuel. Older cars' engines are able to burn gasohol (10% ethyl alcohol); and a computer chip in the fuel systems of this year's midsize Ford and Chrysler minivans permits the use of up to 85% alcohol. Federal fuel economy standards encourage these new "flexible fuel vehicles," and they have fortuitously arrived just as the new technology is ready to reduce alcohol costs. Mixing these fuels with gasoline is now done easily at filling stations that sell gasohol. Environmental costs go down with alcohol: its wide use would lead to a substantial improvement in air quality. And an alcohol spill on an Alaskan shore would produce

nothing worse than dispersal, evaporation and possibly some inebriated seals.

The one real barrier to ethyl alcohol's replacing a large share of gasoline is production cost, which today is comparatively high and volatile. Alcohol's current feedstock, corn, is subject to the caroming behavior of feed markets. In 1995 its price, normally around \$100 a ton, nearly doubled, and the production of alcohol for transportation consequently had to be cut by a third. Ethyl alcohol feedstocks have been limited because the yeast that has been used for millennia in fermentation can only convert food crops. But advanced biocatalysts and genetically engineered microbes now make possible the cost-effective conversion of cellulose: grass, trees and biomass waste.

Even at today's fossil fuel prices, it is likely that as ethyl alcohol's cost declines it will come to be used as the emission-reducing oxygenate that is added to gasoline. But the key issue is whether alcohol derived from biomass can become cheap enough to begin to replace gasoline. Over the past 15 years the cost of producing a gallon of alcohol from corn has been cut in half, to about \$1 a gallon. If the new technology were to make it possible for costs to fall another 30 to 40 cents, alcohol would become competitive with gasoline when oil reaches around \$25 a barrel.

Is such a reduction in cost plausible? Consider switch grass, common on the prairie. The U.S. Department of Energy estimates twice as much alcohol could be produced per acre from it than from corn. Since switch grass requires almost no tilling, planting, fertilizing or other use of fuel or chemicals, using it as a feedstock would yield several times more energy than would be consumed during production -- far better than with either gasoline or corn-derived alcohol. Switch grass and many biomass crops enrich the soil instead of depleting it. Vastly more of the earth's surface is available to grow such grasses, fast-growing trees and aquatic vegetation than is available for feed grains. For example, thinning forests by removing underbrush and small trees reduces forest fires and preserves wildlife habitat -- and some cousin of *zymomonas* would doubtless love to dine on such scrap brush.

10/24/97 WSJ A22

(Publication page references are not available for this document.)

Will oil prices hit \$25 a barrel in a few years, making it possible for even unsubsidized alcohol to replace a large share of gasoline? The Energy Department forecasts a flat market, but the oil bulls have a strong case because of perennial instability in the Mideast and because demand will burgeon as a growing share of the growing population in Asia moves into cities. Fortune magazine noted two years ago that once China's and India's energy consumption per capita reach South Korea's current level, these two countries alone will need almost 120 million barrels of oil a day -- nearly double what the world uses today. In spite of oil discoveries elsewhere, it is likely that at least three-fourths of any new demand will be filled from the huge reserves of the Mideast, transferring more than \$1 trillion over the next 15 years to the autocratic (and worse) states of the unstable Persian Gulf alone, in addition to the annual \$90 billion they receive today.

Thus, if genetically engineered microbes and advanced biocatalysts can start a transition from fossil fuels to biofuels, a major Middle East war involving the U.S. would become less likely. We would become freer to support democracies and our friends -- Israel, Turkey, Jordan -- without weighing whether we might offend an oil state. At the same time, subsistence farmers in Africa and Latin America, paid to grow transportation fuel, would begin to climb out of poverty; Ukraine, rich in fertile land, would become more independent of oil-rich Russia; China would feel less pressure to befriend Iran and to build a big navy to dominate the oil-rich South China Sea.

What's more, new markets for biofuel crops would help rural America to prosper; substantial improvements in air quality would let EPA Administrator Carol Browner stop worrying about our power lawnmowers and let Detroit produce four-wheel-drive sports vehicles to its heart's content; and the U.S. trade deficit would shrink substantially, reducing Wall Street's propensity to panic whenever the Japanese prime minister gets grumpy about holding U.S. debt.

Who would lose? Chiefly oil-exporting states. But many others would need an attitude check: oil

companies, if they resist diversifying; bureaucrats who don't like flexible-fuel vehicles, because they aren't subsidized in their particular fiefdom; environmentalists who don't like them either, because they permit Detroit to build larger cars (the more they burn alcohol, folks, the less you should care); Archer Daniels Midland, which will have to get used to losing its near-monopoly of the ethanol market; and of course Roger Tamraz, because struggles over pipeline routes will become boring.

What would we need to do before the December

Kyoto summit? Just announce that, in view of biofuels' advantages, we are going to use government purchases and policies to help give them a stable market until early in the next century while production gears up, somewhat as we did with silicon chips. We might even add that, except for continuing to do basic research and development, we plan to phase out all energy subsidies (including oil's remaining foreign tax credit) toward the end of that period.

Then we could stand back, and let the new bugs and the market do the rest.

Mr. Woolsey, an attorney in Washington, was director of central intelligence, 1993-95.

--- INDEX REFERENCES ---

NEWS SUBJECT: Agriculture; Editorial & Columns; Environmental News; Petroleum Market (AGR EDC ENV PET)

REGION: North America; United States (NME US)

LAYOUT CODES: Edit Page Articles (EDP)

Word Count: 1214

10/24/97 WSJ A22

END OF DOCUMENT

Date: November 12, 1997
To: Senator Leahy
From: Ed Barron
Subject: Global Climate Change/Alternative Fuels Hearing

The full Agriculture Committee hearing starts at 9:00 a.m.

The hearing provides a great opportunity for you to showcase your early leadership role on this issue. You insisted on including a "Global Climate Change" title in the 1990 farm bill - which forced America to confront these issues -- and turns out in have been very prescient.

Also, the hearing presents a good opportunity for you to support the President's efforts [and Todd Stern's efforts] on global warming prior to the December 1 though December 10 meetings in Kyoto, Japan.

[Yes, or should I say "hai," I can pack my bags at a moment's notice! My five courses in Japanese language will come in very handy. Sayonara.]

The witnesses are:

Mr. James Woolsey, former C.I.A. Director
Mr. Reid Detchon, Biomass Energy Advocates

Senator Lugar will support the use of alternative fuels to reduce greenhouse gas emissions and talk about Kyoto. His press release talks about how the hearing:

in advance of the environmental summit in Kyoto, Japan, will examine the role of agriculture in creating alternative energy resources It is critical that the world's rain forests and other ecologically crucial areas are not desperately uprooted for use as farmland and fuel sources.

Attached is a *Wall Street Journal* article by James Woolsey entitled "Alcohol and Driving Can Mix."

Also, two charts are attached. Your book tomorrow will have the color versions of them if you want to use them.

Today's *Washington Post* has two full pages on these issues.

Testimony

URGENT

Total Pages: 6

LRM ID: AER242

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

'97 NOV 10 AM 10:5

Monday, November 10, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO:

Legislative Liaison Officer - See Distribution below

FROM:

Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT:

John D. Burnim

PHONE: (202)395-3522 FAX: (202)395-3307

SUBJECT:

STATE Oversight Testimony on Global Climate Change

DEADLINE:

3:30 P.M. Monday, November 10, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: If your agency does not respond by 3:30 P.M. Today, we will presume that your agency has no comment.

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118-TREASURY - Richard S. Carro - (202) 622-0650

EOP:

Christopher S. Johns
Todd Stern
Tuccillo Robert

NOV-10-1997 10:25 TO:TODD STERN

FROM:ROONEY, A.

P. 2/6

William J. McQuaid
David B Sandalow
Michele Jolin
Dirk Forester
Daniel C. Tate
Lucia A. Wyman

Statement By
Acting Assistant Secretary Melinda L. Kimble
Subcommittee on Readiness
Senate Committee on Armed Services
November 12, 1997

Thank you for this opportunity to inform your committee about the status of the international climate change negotiations, including with respect to military training and readiness related to greenhouse emission reductions. The U.S. delegation finished its latest round of negotiations work on October 31 at the Eighth session of the Ad Hoc Group on the Berlin Mandate (AGBM) and what was to have been the last formal "pre-negotiation meeting" prior to the meeting of the Third Conference of the Parties (COP-3) in Kyoto. Because further preparatory work remains, governments will reconvene for a half day on November 30 and a half day on December 1 before COP-3 begins on the afternoon of December 1.

President Clinton's announcement of the U.S. target for reduction of greenhouse gas emissions on October 22 changed the dynamic of the negotiations. His speech marked the beginning of a new initiative to undertake realistic and achievable efforts to reduce greenhouse gas emissions. In his speech, the President outlined a flexible, market-based and cost-effective approach, backed by a comprehensive domestic program to help meet the ambitious target to return greenhouse gas emissions to 1990 levels in a budget period between 2008 and 2012. This target will be followed by a reduction below 1990 levels in the five-year period thereafter, and an effort to make further reductions in the years beyond that. Unlike the EU and others' proposals, the U.S. plan takes a comprehensive view with regard to the gases to be included. We are prepared to address a broad range that includes the extremely potent greenhouse gases such as HFCs, PFCs, SF6 and all land use and forest sinks. In real terms, the U.S. commitment amounts to a 22 percent reduction in emissions of carbon below where they otherwise would be in 2010, accompanied by significant reductions in emissions of other greenhouse gases.

A major element of the President's proposal is the call for both industrialized and developing countries to participate in meeting the challenge of climate change. While developed countries must lead, he stated that key developing nations must meaningfully participate; otherwise, the United States will not assume binding obligations. Their involvement is vital to addressing the global problem we face. These nations have an opportunity to chart a different energy future.

The President also placed great emphasis on the need to rely on a series of flexible mechanisms for achieving binding limits and lowering costs. Innovations such as emissions trading and joint implementation with credit can cut worldwide pollution and help developing countries protect their own environments without sacrificing economic growth.

Our negotiators worked with other delegates at the Bonn meeting to develop the text for a protocol or other legal instrument for consideration at COP-3 that is consistent with the U.S. proposal. Although we saw movement in some areas critical to the overall U.S. position, most important issues within the text remain bracketed and are far from agreed. These include sections on emissions trading, joint implementation, commitments by developing countries, harmonized policies and measures, multi-year emissions budgets, the treatment of carbon sinks, and the level of target reductions of greenhouse gas emissions by Annex I countries, as final consensus has not yet been reached on these still contentious points.

Reaching consensus with other negotiating Parties on these issues has been and will continue to be a difficult task: the Group of 77 countries and China worked to block the text in several areas and reintroduced text to reflect their insistence on no new commitments from developing countries, and to obtain new concessions from developed countries on financing and the transfer of "climate-friendly" technologies. Thus, with only a one month until the Conference of the Parties at Kyoto, much work needs to be done on many outstanding and difficult issues.

Initiated in January of this year, U.S. policy on climate change became fully fleshed out with President Clinton's announcement of the U.S. target last month. Kyoto marks the next step in a series of steps that will enable the United States and all nations to fulfill the Climate Convention's ultimate objective. It will not be an easy road to Kyoto, but through an intensive, comprehensive diplomatic effort, we will increase our chances for success considerably.

The Department has been working closely with the Department of Defense and other U.S. Agencies in developing a national position on climate change which ensures our ability to conduct worldwide military operations. Based on consultations to date with our colleagues in DOD, we are exploring with our allies a possible provision for the protocol that would provide that national limits on emissions would not apply to emissions related to multilateral operations conducted by militaries for self-defense, peacekeeping, peace enforcement, and humanitarian assistance purposes. We are also exploring how we can deal with military-related issues through domestic implementation.

Efforts to date have included sending representatives of OSD and the Joint Staff to Bonn for participation in the negotiations leading up to the Kyoto Conference. The negotiating team in Bonn made a verbal intervention in the meeting's plenary session to all delegations raising this important issue. Our statement said as follows:

"This Protocol must not create a conflict between our collective ability to preserve peace and the need to reduce greenhouse gas emissions. We must pursue both goals. We believe we have an obligation to the world community, our individual nations, and to the men and women who serve in our military forces to carefully consider how we address the implications of this Protocol for military operations."

Prior to making this statement in Bonn, the Department demarched our NATO allies and other selected nations in October, asking for their reaction to the concept of a provision in the protocol. Overall reaction has ranged from firm, positive supports to neutral. Some have yet to provide a full response to our demarche. A similar solicitation has been, or will soon be made by the CINCs on a military-to-military level.

Other Governments, including within NATO, have raised a number of questions about the U.S. concerns. In order to make headway with those governments, we will need to answer their questions about the impact of military operations on global warming. Questions include the amount of emissions related to U.S. operations on U.S. territory, outside of U.S. territory, and potentially in locations which would affect the emission limits of allied states. Once we have further defined the issues and impacts, as provided by DOD, we will be in a better position to gain a positive resolution of this important issue in Kyoto.

In the meantime, we will work with DOD to ensure that U.S. defense interests and issues will be fully represented in the negotiating instructions for the U.S. delegation at Kyoto. We will be looking forward to working with DOD to assist us diplomatically with the issue over the course of the negotiations in Kyoto, as they have done both in Bonn and, more recently, at this past weekend's informal Ministerial-level consultations on climate change in Tokyo that were hosted by the Government of Japan.

URGENTTotal Pages: *6*

LRM ID: AER242

**EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001**

'97 NOV 10 AM 10:51

Monday, November 10, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below
Ronald K. Peterson
FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference
OMB CONTACT: John D. Burnim
PHONE: (202)395-3522 FAX: (202)395-3307

SUBJECT: STATE Oversight Testimony on Global Climate Change

DEADLINE: 3:30 P.M. Monday, November 10, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: If your agency does not respond by 3:30 P.M. Today, we will presume that your agency has no comment.

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EOP:

Christopher S. Johns
Todd Stern
Tuccillo Robert

**RESPONSE TO
LEGISLATIVE REFERRAL
MEMORANDUM**

You may also respond by:

- Please include the LRM number shown above, and the subject shown below.

FROM: _____ (Date)
 _____ (Name)
 _____ (Agency)
 _____ (Telephone)

☐ **Concur**
☐ **No Objection**
☐ **No Comment**
☐ **See proposed edits on pages** _____
☐ **Other:** _____

FAX RETURN of _____ pages, attached to this response sheet

Statement By
Acting Assistant Secretary Melinda L. Kinable
Subcommittee on Readiness
Senate Committee on Armed Services
November 12, 1997

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"This Protocol must not create a conflict between our collective ability to preserve peace and the need to reduce greenhouse gas emissions. We must pursue both goals. We believe we have an obligation to the world community, our individual nations, and to the men and women who serve in our military forces to carefully consider how we address the implications of this Protocol for military operations."

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RJN 214 b

URGENTTestimony 10 221
Total Pages: 8

LRM ID: RJN244

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

Thursday, November 6, 1997

'97 NOV 7 PM 5:3

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below

FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT: Christopher S. Johns
PHONE: (202)395-3798 FAX: (202)395-5722

SUBJECT: Oversight Testimony by the Armed Services - U.S. Navy and U.S. Air Force testimony on the Global Climate Change Protocol

DEADLINE: ~~COB Friday, November 7, 1997~~

1:00 PM, Mon. Nov 10, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: The following testimony is for a hearing before the Senate Armed Services Committee on the Global Climate Change Protocol on Wednesday, November 12th. The Committee has requested all testimony by COB, Friday, November 7th.

Additional statements from DOD and the other services are forthcoming, and will be circulated for your review ASAP.

If your agency does not respond by the deadline, this Office will assume that you have no comment on the Navy or Air Force statements.

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EOP:

Todd Stern
Tuccillo Robert
William J. McQuaid
David B Sandalow
Michele Jolin
Dirk Forester
Daniel C. Tate
Lucia A. Wyman

Gene Sperling

Office of the Secretary of the Army
Office of the Chief of Legislative Liaison
Investigations and Legislative Division
1600 Army Pentagon Washington, D.C.
Room 2C634

Date: 11/7/97Number of pages: H+ 4To: Holly Fitter
OMB

Phone: (202) 395-3233

FAX: (202) 395-5691

From: Corinna Murdock

Subject: ----- Statement for OMB Clearance -----

MG Howard J. Van Kannel, Director Strategy, Plans &
Policy, DCSOPS, - 12 Nov 97 before the SASC

Comments: Holly -

I spoke to Col Nassif at 1:45pm - He said
you'd get this sent to the right OMB POC -
apparently there is high-level interest
all the way to the White House. POC
for technical questions is CAPT Pete Najaera,
695-6318 - otherwise you can call me.
Thank you for your help with this.

Faxed: 11/7/97

Time: _____

Job# _____

By: Corinna

Telephone: (703) 697-2106

FAX: (703) 614-3035

S.
Sorry for the
delay - We'll try
to improve our
routine in the
future!

RECORD VERSION

STATEMENT BY

MAJOR GENERAL HOWARD J. VON KAENEL

DIRECTOR OF STRATEGY, PLANS AND POLICY
OFFICE OF THE DEPUTY CHIEF OF STAFF FOR OPERATIONS AND PLANS
DEPARTMENT OF THE ARMY

BEFORE THE

COMMITTEE ON ARMED SERVICES

UNITED STATES SENATE

FIRST SESSION, 105TH CONGRESS

ON THE

IMPACT ON THE ARMY OF POTENTIAL FUEL REDUCTIONS
UNDER THE GLOBAL CLIMATE CHANGE TREATY

12 NOVEMBER 1997

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FOR OPEN PUBLICATION

NOV 7 1997 6

DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW (CAGD-PA)
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**STATEMENT OF
MAJOR GENERAL HOWARD J. VON KAENEL
DIRECTOR OF STRATEGY, PLANS AND POLICY
OFFICE OF THE DEPUTY CHIEF OF STAFF
FOR OPERATIONS AND PLANS
DEPARTMENT OF THE ARMY
BEFORE THE SASC
THE POTENTIAL IMPACT ON THE ARMY OF PROPOSED
GREENHOUSE GAS EMISSION REDUCTIONS UNDER
THE GLOBAL CLIMATE CHANGE TREATY**

DIRECTORATE FOR FREEDOM OF INFORMATION
AND SECURITY REVIEW (OASD-PA)
DEPARTMENT OF DEFENSE

Mr. Chairman and members of the Committee:

I am pleased to appear before the Committee today to discuss the potential impacts on the Army's military training and readiness levels related to the greenhouse gas emission reductions proposed in Protocols to the Framework Convention on Climate Change.

The Army fully supports the current Department of Defense position calling for a protocol to the convention that preserves national security and protects our nation's ability to conduct military operations with trained and ready forces while supporting Administration goals of reducing global greenhouse gas emissions. As you know, the current draft protocol to the convention does not address national security or military activities in any way. The Army has been an active participant with the Joint Staff and Department of Defense in crafting a provision that exempts greenhouse gas emissions that are attributed to military and military support systems used in the preparation for, in support of, or engagement in military operations. Specifically, military operations for national or collective security, humanitarian activities, peacekeeping, peace enforcement or United Nations and other multinational actions must not be subject to an emissions limit. This type of "national security provision" is necessary to maintain the Army's ability to execute the National Military Strategy in support of the President's National Security Strategy. In this regard, any protocol that is negotiated within the treaty must not threaten the Army's ongoing contributions to shaping the international environment and creating conditions favorable to global security. Additionally, the protocol must not adversely affect our readiness to respond to the full spectrum of crises with trained and ready forces.

To achieve the objectives outlined in our strategy, the Army must maintain the capability to fulfill four strategic purposes: reassure friends and allies, deter potential adversaries, compel an enemy force in the event of confrontation or hostilities, and support the nation in times of domestic crisis. Our ability to fulfill these purposes depends on trained and ready forces based in the Continental

United States and forward-deployed, who are prepared to respond on a moment's notice to the needs of the Nation. Since 1990 alone, the Nation has called upon the Army to deploy forces 25 times with little or no notice, and, given the conditions that characterize the emerging strategic environment, there is every indication that this trend will continue. Reductions in fossil fuels consumed by Army units for training will ultimately result in lower readiness rates, reducing our ability to respond to an emergency in a timely manner.

Fulfilling the Army's strategic purposes also requires that we sustain a high level of engagement activity abroad. Today the Army has over 33,000 soldiers deployed in 71 nations. Additionally, soldiers remain forward stationed in both Korea and Europe, demonstrating our commitment to regional stability. Exercises such as "Bright Star" in Egypt, "Intrinsic Action" in Kuwait, and "Cobra Gold" in Thailand are further examples of the Army's commitment to remaining globally engaged. Should we be forced to reduce fossil fuel consumption, it is doubtful that we could sustain an appropriate level of engagement. Though the Protocol to the Convention is still being negotiated and its defined terms and implementation plan remain undetermined, specific impacts are likely to be complex and far ranging. Some crucial questions for important ongoing operations overseas are:

1. How will critical engagement activities like military-to-military contacts and Partnership for Peace programs be affected?
2. Will our current efforts to address transnational threats such as drug trafficking and Weapons of Mass Destruction proliferation be impacted?
3. How will emissions be accounted for in humanitarian operations in Rwanda, de-mining operations in Africa, or peace keeping operations in Bosnia?
4. Will access to international bases, airfields and ports be affected?
5. Will airlift and sealift assets vital to our force projection Army be able to travel unencumbered without regard to where they procure or consume fuel in other nations?
6. Will forward deployed soldiers and their families continue to receive the appropriate host nation support to preserve their quality of life?

Additionally, any negotiated Protocol must not create a disincentive to other nations to participate in multinational exercises and operations that support our mutual security interests. Nations should not be put into the position of having to choose between greenhouse gas reduction targets and activities important to national and international security.

The Army does recognize the hazards of global warming and has been participating in supporting the nation and the world in meeting emissions reduction targets. We have done so by pursuing a considered strategy that balances energy reduction objectives with readiness requirements. The Army has made great strides in energy conservation through implementing energy efficient measures in its installation infrastructure. Since 1985, the Army has reduced its facility energy consumption by 18.9% and is on the glide-path to achieve a full 30% reduction by 2005 as mandated under the Energy Policy Act of 1992 and Executive Order 12902. In response to these same laws, and through down-sizing the force, the Army has achieved a 39% reduction in mobility fuel consumption since 1985, far exceeding the 10% reduction mandated in this category. These figures put the Army well below the 1990 emission levels that were originally established as the baseline for reductions in the 1992 Rio Summit. These early achievements in reducing mobility fuel consumption cannot be matched in the near and mid-term without significant readiness degradations.

There are other near term initiatives. The Army is developing a family of simulators that will assist in meeting training readiness, and will provide modest reductions in our fossil fuel emissions by reducing some field training requirements. For example, the Close Combat Tactical Trainer (CCTT) and the Fire Support Combined Arms Tactical Trainer (FSCATT) are two such simulators that the Army has developed and is fielding. They provide the means for tank crews and self-propelled howitzer crews to accomplish a portion of required training with minimal consumption of fuel and other resources.

The Army is also pursuing several long-term science and technology programs that are focused on reducing fuel demand in future weapons systems that hold the promise of further reductions in emissions. These include investments in research for high performance turbine engine technology, composite armor technology to reduce vehicle weights, and hybrid electric power systems for combat vehicles.

Environmental concerns and considerations will continue to be important as we strive to design forces and capabilities for the Army of the next century, however, fighting and winning the Nation's wars as part of the joint team remains the Army's foremost task. Thus, remaining trained and ready is crucial, and we are therefore committed to supporting the inclusion of a national security provision in the current Protocol for Climate Change Convention.

I appreciate this opportunity to appear before the Committee. The Army will continue to work with our colleagues in the other Services, the Joint Staff, the Department of Defense, and with the members of Congress to ensure we preserve the nation's ability to conduct military operations and protect national security while simultaneously maintaining our environmental stewardship responsibilities. I look forward to answering any questions that you may have. Thank you.

URGENTTotal Pages: 13

LRM ID: RJN214

**EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001**

'97 NOV 6 PM7:35

Thursday, November 6, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below

FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT: Christopher S. Johns
PHONE: (202)395-3798 FAX: (202)395-5722

SUBJECT: Oversight Testimony by the Armed Services - U.S. Navy and U.S. Air Force
testimony on the Global Climate Change Protocol

DEADLINE: COB Friday, November 7, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: The following testimony is for a hearing before the Senate Armed Services Committee on the Global Climate Change Protocol on Wednesday, November 12th. The Committee has requested all testimony by COB, Friday, November 7th.

Additional statements from DOD and the other services are forthcoming, and will be circulated for your review ASAP.

If your agency does not respond by the deadline, this Office will assume that you have no comment on the Navy or Air Force statements.

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RESPONSE TO LEGISLATIVE REFERRAL MEMORANDUM

_____ Concur

_____ No Objection

_____ No Comment

_____ See proposed edits on pages _____

_____ Other: _____

_____ FAX RETURN of _____ pages, attached to this response sheet



Secretary of the Air Force

Office of Legislative Liaison
Programs & Legislation Division
The Pentagon, Room 5D927

DATE: 6 Nov 97

TO: ~~XXXXXXXXXX~~

OFFICE: OMB

PHONE: ~~(202) 305-7000~~FAX: ~~(202) 305-6000~~

FROM: SAF/LLP

NAME: MSgt Neal Graham

PHONE: (703) 693-9113

FAX: DSN: 227-3520

COMMERCIAL: (703) 697-3520

SUBJECT: Global Climate Change Protocol HearingTOTAL PAGES INCLUDING THIS COVER SHEET: 3REMARKS: Senate Armed Services Committee has requested testimonyNLT COB 7 Nov 97, Friday. Request Clearance by that dateWITNESS: Maj Gen PetersonHEARING DATE: 12 Nov 97

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Mr. Chairman and members of the Committee, I greatly appreciate the opportunity to appear before you this morning to discuss the impact of an International Global Climate Change Protocol on the training and operational readiness of our Air Force - the world's most capable air and space force.

The Air Force fully supports the DoD and the President's framework for an International Global Climate Change Protocol. We believe the current DoD position that endorses a Protocol which includes a National Security Provision, or other arrangements that provide similar protection for ourselves and our allies, balances our national security and environmental goals. This provision will protect our ability to conduct operations as directed by the National Security Strategy while ensuring we have a well trained and ready force to carry out our assigned missions. Our Air Force has a strong record of improving our environment and reducing energy consumption while maintaining the required levels of readiness. Within our fiscal resources, we are continuing to increase the efficiency of our operations in order to meet our energy savings goals.

Over the past several years the Air Force has instituted and continues to pursue numerous energy reduction measures. These measures, combined with the drawdown of our force, have resulted in a dramatic reduction in aviation fuel consumption since 1990. These reductions occurred despite the fact that since 1990, the Air Force deployment rate has risen 400% supporting numerous UN resolution enforcement missions (Bosnia, Iraq, etc.), international humanitarian, peacekeeping, noncombatant evacuation, and disaster relief missions. Part of this improvement is due to new weapons systems we have developed that are more efficient than their predecessors. For example, the C-17 is 37% more fuel efficient than the C-141. The on-going upgrade of the KC-135 to the new R-model engines saves 21% on fuel consumption, for an average saving of \$1,650 per flying hour. Further reductions are built into nearly every program we execute. For example, we continue the saving trend with the F-22 Raptor, designed to be far more fuel efficient at high airspeeds than current fighters. In addition, we are transitioning significant flight training to simulators to save further fuel consumption. C-17 aircrews already perform 50% of their initial and recurring training in the simulator, while our KC-10 and KC-135 aircrews will reach that plateau in 2002. In facilities, we have exceeded federal energy

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reduction goals for energy use per square foot, and we will further reduce those numbers each year. In short, the Air Force has an aggressive plan already underway to continuously reduce our energy consumption.

Arbitrarily reducing Air Force energy consumption could have serious safety and readiness impacts, and break the delicate balance we maintain between energy conservation and mission readiness. Any cut would result in a proportionate cut directly from flying hours. Such a loss could result in several significant reductions in readiness – the degree of additional reduction would determine the severity of impact. Listed below are a host of immediate potential impacts that could be realized were even minimal additional reductions imposed on Air Force fuel consumption.

- Forfeiture of fighter and bomber special mission capabilities due to lack of training hours
- Inability of the airlift fleet to meet its wartime or current peacetime mission requirements
- Transportation Working Capital Fund losing large amounts of revenue and forcing its customers to seek transportation elsewhere at potentially higher cost
- Reduction in tanker forces ability to support training and operational sorties, not only for the Air Force, but their large sister Service and Allied customer base
- C-130 aircrews being unable to fulfill airdrop training requirements that would directly affect Army mission readiness
- Inability of command and control, reconnaissance, search and rescue, and intelligence aircraft to meet the current level of JCS tasking in Bosnia, Iraq, and counterdrug operations
- Reduction of aeromedical evacuation training flights
- Reduced testing of new aircraft and aircraft technologies thereby prolonging weapons development and increasing costs
- Loss in schoolhouse training at a time when we are ramping up pilot and navigator training to compensate for serious shortages

Of course, any attempt to protect one mission area would result in even more drastic cuts in all the others. There is also a potential for increased mishaps as reducing flying time would reduce pilot proficiency. **Net result: The Air Force ability to fully support the National Security Strategy would clearly be reduced.**

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Along those same lines, our allies must have similar protective provisions in the Protocol for their national security missions as well as their participation in multi-national operations and training. The US military operates routinely with allied and host nation forces, and bases a portion of its National Security Strategy on allied contributions. Without equal protection for our allies, US operations will be hampered, thereby significantly reducing our overall capability.

Furthermore, we believe the National Security Provision should exclude deployed military forces from being counted against a host nation's consumption quota or credits. Such a provision is critical as our extensive global deployments put US-flagged aircraft and personnel in dozens of countries every day and virtually every country in the world each year. We support many of our international operations through the purchase of fuel from our host nations. A quota or credit system without a National Security Provision could result in our Air Force or allies/host nations paying premium prices, or an ally or host nation becoming unwilling or unable to provide the required fuel. The impact would be a reduction in both US and allied nations' ability to train and operate together, and therefore decrease allied readiness.

The Air Force is committed to further reducing its energy consumption in both facilities and operations. We have already met the goals of the Rio Summit by reducing our fuel consumption below 1990 levels, and we are on track for additional savings despite our numerous global commitments to UN support, peacekeeping, and humanitarian missions. These reductions are best made intelligently over time, not overnight. Correspondingly, our weapon systems are very long lived compared to our civilian counterparts', with some aircraft lasting 30-40 years or longer. In a fiscally constrained environment we cannot appreciably accelerate the replacement of all weapons systems with newer, more efficient systems. But we have a plan that includes progressively greater energy savings and efficiencies, and we ask that Congress support a National Security Provision, or some arrangement that provides similar protection for our military and those of our allies, to prevent arbitrary cuts leading to a potentially severe drop in readiness and safety.

Thank you for the opportunity to appear before your Committee. I look forward to answering your questions.

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Navy Office of Legislative Affairs
Legislation Division
(LA-6)



Date: 6 Nov 97

Pages including cover: 6

To: ~~Mr. [illegible]~~ ~~Mr. [illegible]~~

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From: Ms. RAINEY

Remarks: I'm faxing RDM Moore's Statement
for clearance. Requesting clearance by 7 Nov 97
1500 in A.M. Any questions contact LCDR
Shaffer at 703-697-5946

FAX: (703) 695-9891
Phone: (703) 695-4926

DSN: 225-9891
DSN: 225-4926

DRAFT

STATEMENT OF
REAR ADMIRAL EDWARD MOORE
ASSISTANT DEPUTY CHIEF OF NAVAL OPERATIONS
(PLANS, POLICY, AND OPERATIONS)
BEFORE THE READINESS SUBCOMMITTEE
OF THE
SENATE ARMED SERVICES COMMITTEE
ON
GLOBAL CLIMATE CHANGE TREATY AND NAVY OPERATIONS
NOVEMBER 12, 1997

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I'm pleased to be here today testifying on behalf of the Navy regarding Global Climate Change. I want to thank you for the opportunity to deliver the Navy's point of view on this important issue. During my testimony today, I would like to address three main points:

First, the Navy supports the Global Climate Change framework proposed by President Clinton. We feel that National Security can be preserved while taking action to combat climate change.

Second, I would like to discuss the progress that the Department of the Navy has already made in preserving our environment and conserving natural resources. The primary sources of greenhouse gases emitted from Navy assets include aircraft and ship propulsion systems, and energy consumption at our shore facilities. The Navy has made significant strides to reduce emissions in all of these areas.

Between 1990 and 1997, 149 Navy and Marine Corps bases have been closed or realigned, representing a significant reduction in our overall greenhouse gas emissions. The existing Navy Shore Energy Conservation Program focuses on reducing costs and energy usage while improving operational capability. Since 1985, the Navy energy program has reduced energy consumption at our shore facilities by approximately 20% per square foot. Additionally, the Navy is working towards a goal of reducing our energy consumption at these facilities a total of 30% by the year 2005.

Here are some specific examples of the Navy's achievements in energy reduction in both shore facilities and at-sea operations:

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- At Patuxent River Naval Air Station, a shared energy savings contract completed lighting retrofits in 52 buildings in January 1992. These efforts reduced energy consumption by 38.3 billion BTU's over a three year period in addition to saving taxpayers a projected \$700,000 over a ten year period. In addition, energy production from renewable sources in the Department of the Navy such as the Geothermal Energy facility at Naval Air Weapons Station, China Lake, California has risen to 16 percent of total shore energy consumption.
- In the operational area, the Navy has taken several steps to reduce fossil fuel consumption of our ships and aircraft. Since 1990, we have reduced total emissions as we have drawn down from 550 ships to 347 ships in our battle force, a reduction of 37%. We have instituted a program to achieve energy savings by routing ships at sea to take advantage of ocean currents. We also continue to evaluate the design of future weapons systems that are both energy efficient and environmentally friendly. We are currently funding research to demonstrate the viability of a bulbous bow concept for our DDG-51 class destroyers. The bulb will decrease fuel consumed for ship propulsion by approximately 4%. Fuel savings will be achieved due to reduced hull resistance without affecting other ship performance characteristics.
- Other ways that we are examining to reduce greenhouse gas emissions aboard ships include upgrades to air conditioning and cooling systems as well as high-efficiency lighting fixtures. For application to future ship design, we are funding research to develop fuel cells for shipboard use to generate electric power with reduced carbon dioxide and unburned

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hydrocarbon emissions. These high-technology power plants will be 20-30% more fuel efficient than our present generators and reduce emissions proportionately. For aircraft operations, we are in the process of implementing fleet-wide the use of computerized flight management systems that provide 2-4% fuel savings for each mission by analyzing variables such as aircraft weight, fuel load, and aerodynamic drag for each class of aircraft.

As a final point, I would like to emphasize that although the Navy supports the administration's efforts for energy conservation and the reduction of greenhouse gases, it is important to stress our concern about the potential impacts of this treaty on our readiness. Since the actual provisions of the treaty are unknown, it is difficult to ascertain the exact effect the treaty would have upon Naval operations. However, it is possible to come to some conclusions on potential impacts that any forced reduction would produce.

On the domestic front, any incremental mandatory reduction in emissions could lead to a cut of flying hours and steaming days available for training the crews of our ships and aircraft. Any training cuts in addition to those necessitated by past draw-down efforts would lead to the potential for decreased readiness and safety.

We are also concerned about the impact that the treaty would have on our multilateral operations overseas. For example, today our forward-deployed Naval Forces are conducting eight multilateral exercises and we have ships visiting eleven foreign countries. We must work carefully to ensure that our forces are able to continue these engagement activities unencumbered. Another important issue concerns accountability for emissions from fuel that is bunkered in overseas ports.

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There are currently no plans at the Kyoto conference to discuss how emissions from bunker fuels used by our aircraft and ships overseas will be allocated among various nations. It is imperative that the treaty provisions do not hamper our ability to operate in international and foreign waters, base and refuel our forces in overseas ports, and participate in multinational training, exercises, and operations.

Mr. Chairman, the Navy does not want to get into the business of budgeting BTU's the way we currently budget dollars. The next time Naval Forces are called upon to respond to a crisis around the globe as they have been many times in recent years, we do not want the Carrier Battle Group Commander or Amphibious Task Group Commander to have to ask, "Is this operation within our greenhouse gas emissions budget?" Neither do we want our allies to ask themselves the same question prior to cooperating with the United States on a joint enterprise.

In conclusion, the Department of the Navy is committed to identifying economically viable opportunities for shore facilities and operational components that reduce greenhouse gas emissions without adversely impacting military readiness. We strongly believe the protocol must include a provision that preserves our ability to conduct Naval operations and training necessary to meet our national security commitments.

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**EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001**

Thursday, November 6, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below

FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT: Christopher S. Johns
PHONE: (202)395-3798 FAX: (202)395-5722

SUBJECT: Oversight Testimony by the ~~Armed Services~~ *Dept of Defense* U.S. Navy and U.S. Air Force
testimony on the Global Climate Change Protocol

DEADLINE: COB Friday, November 7, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: The following testimony is for a hearing before the Senate Armed Services Committee on the Global Climate Change Protocol on Wednesday, November 12th. The Committee has requested all testimony by COB, Friday, November 7th.

Additional statements from DOD and the other services are forthcoming, and will be circulated for your review ASAP.

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SUBJECT: Ms Goodman's Statement

Remarks/Special Instructions:

Chris,
Attached is Ms. Goodman's Statement on Global Climate Change. This draft copy will be sent to OSD (Security Review) tomorrow morning. I don't expect any changes from their review. Please begin approval process and contact Steve Cary, (697-7363) with any questions, comments, etc. The hearing is scheduled for Wednesday, Nov 12, so we would like to get ~~an~~ OMB's approval quickly. Thanks for your help.

Fred Sylvester

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SENATE ARMED SERVICES COMMITTEE**

**GLOBAL CLIMATE CHANGE -
NATIONAL SECURITY ISSUES**

STATEMENT OF

SHERRI W. GOODMAN

**DEPUTY UNDER SECRETARY OF DEFENSE
(ENVIRONMENTAL SECURITY)**

BEFORE THE

SENATE ARMED SERVICES COMMITTEE

SUBCOMMITTEE ON READINESS

NOVEMBER 12, 1997

**NOT FOR PUBLICATION UNTIL RELEASED BY THE
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11/06/97 1915

**STATEMENT OF
SHERRI W. GOODMAN
DEPUTY UNDER SECRETARY OF DEFENSE
(ENVIRONMENTAL SECURITY)
BEFORE THE SASC**

GLOBAL CLIMATE CHANGE • NATIONAL SECURITY ISSUES

I want to thank you for the opportunity to testify today on behalf of the Department of Defense regarding Global Climate Change. The Department supports President Clinton's proposed Global Climate Change framework and we believe it is compatible with our national security goals. In fact, the President has committed that we will continue to protect national security in taking action to address climate change. I can assure you that the President, the National Security Council, and the Department of State are working very hard with us to ensure that concerns related to limitations on emissions connected with military operations are addressed in the Protocol; indeed, the US delegation made the following statement in October at the negotiations in Bonn on climate change:

"This Protocol must not create a conflict between our collective ability to preserve peace and the need to reduce greenhouse gas emissions. We must pursue both goals. We believe we have an obligation to the world community, our individual nations, and to the men and women who serve in our military forces to carefully consider how we address the implications of this Protocol for military operations."

During my testimony today, I want to discuss three main points:

1. First, the Administration is working to ensure that the climate change protocol now being negotiated, as well as the domestic legislation that would be needed to implement the

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protocol, protects national security. The Administration's goal is to ensure that there are no impediments to our ability to conduct military operations with trained and ready forces.

2. Second, reducing greenhouse gas emissions and energy consumption can be both financially and operationally beneficial. Therefore, the Department of Defense is committed to pursue such reductions to the extent consistent with national security, and
3. Third, if the United States, together with the other nations of the world, does not take action to reduce greenhouse gas emissions, the resulting changes to the global climate will lead to instabilities around the world that will themselves threaten our national security. To prevent these, we fully support the President's global climate change proposal.

Global Climate Change and National Security-- Preserving Readiness

The three core objectives of President's National Security Strategy are: "to enhance our security with effective diplomacy and with military forces that are ready to fight and win; to bolster America's economic prosperity; and to promote democracy abroad." As the deliberations on the Global Climate Change Protocol proceed, the Department is determined to protect the nation's ability to conduct military operations with trained forces, both unilaterally and with other nations. To achieve this, both the Global Climate Change Protocol and our domestic implementation strategy must recognize national security implications. Before I describe what we are doing in each of these important areas, I want to emphasize that the Administration is committed both to protecting national security and to reducing greenhouse gas emissions.

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Within the Department, we have shown and will continue to show leadership in reducing our energy use and emissions of greenhouse gases, without affecting our national security obligations. In fact, it is in our best interest to improve the fuel efficiency of DoD operations. Reducing our energy and fuel use reduces operational costs, freeing up operations and support dollars for other critical needs, reduces the logistics portion of military operations, and in some cases, like the use of the electric hybrid vehicle, may in fact provide stealth characteristics (by reducing noise and heat signatures of combat vehicles). I will discuss the Department's past and present efforts to reduce greenhouse gas emissions in some detail later in my testimony.

International issues associated with the proposed Greenhouse Gas Protocol

The President's National Security Strategy promotes regional stability by promoting "the building of coalitions, forward stationing or deployment of forces; Defense cooperation and security assistance; training and exercises with allies and friends; and the security of key allies and friends through alliances and coalitions." Today the US military operates in 70 countries and is involved in 11 multi-national exercises. Over the past decade, the United States has responded to a major regional conflict and conducted an array of major contingency operations that include: peace operations (Bosnia), disaster relief (Indonesia forest fires), humanitarian assistance (Operation Provide Comfort), noncombatant evacuation (Sierra Leone), maritime escort (Persian Gulf), migrant rescue and support and deployments to quell civil disturbances (Haiti), to name a few. A common feature in most of these operations is their multi-national composition of forces.

As these examples illustrate, our national security interests require that the US maintain a capability to operate internationally in multilateral operations. We do not want potential partners

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forced to choose between meeting their Global Climate Change reduction targets or supporting the US in a contingency operation. This choice could arise in several ways. For example, an unexpected increase in a nation's own military operations could cause it to exceed its reduction target. Alternatively, because the current draft of the protocol does not resolve the issue of emissions from aircraft and ships associated with bunker fuels (fuels used for international transport), an allied country that provides US forces access to its bases could exceed its target due to the emissions from the US forces.

As an illustration of the second possibility, during Desert Shield/Desert Storm, airlifting US forces and equipment to the region required the support of several US allies. Over the initial seven months of the conflict, one country provided access to airlift aircraft and sold US forces an average of 2.7 million gallons a day (563 million gallons overall) of fuel, about six percent of the host nation's daily fuel use. This is a significant amount. In future overseas deployments, we do not want allied countries to have to consider whether providing logistical support will cause them to exceed their greenhouse gas emission targets, nor do we wish to create a situation where countries are forced to choose between their domestic economic growth and supporting international military operations.

To help avoid such a choice, the Department is working to ensure that the Protocol recognizes the unique nature of military operations. The exact form that such recognition should take is still being discussed within the Administration and with our allies. In general, however, the provision must take into account United States military emissions as well as those of other countries where our forces are based and deployed and with whom we engage in combined operations.

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DRAFT***Likely effects of the US domestic implementation strategy on readiness and national security***

To implement any climate change treaty protocol, the Administration intends to use market based mechanisms to achieve domestic reductions of greenhouse gases. Within this market-based framework, DoD is working to ensure that we will always have access to the fuel necessary to carry out the defense mission. This means that whatever market-based system is put into place, our operations and training must not be limited by our ability to purchase fuel or by the amount of emissions that would result from its use. **As he indicated in his October 22nd speech to the National Geographic Society, the President is committed to protect National Security both in the international negotiations and in developing his policy for domestic implementation.**

Reducing Greenhouse Gas Emissions in DoD

DoD is the largest energy user in the federal government and because most greenhouse gas emissions in the United States result from combustion of carbon-based fuels, DoD is also the federal government's largest emitter of greenhouse gases. In Fiscal Year 1996, DoD's energy consumption was about 1.4% of the total energy use in the United States. Of the total DoD energy use, 58% was related to operations and training in military tactical and strategic systems. The remaining 42% of DoD energy use was consumed by facilities and non-tactical vehicles.

This distinction is important. Our national security concerns are focused on the first category -- operations and training. As I have already explained, the Department is seeking to preserve our ability to conduct military operations with trained and ready forces. We are not seeking special treatment for our facilities and non-tactical vehicles. We in DoD can and should reduce our emissions in these areas just as the rest of the nation will be called on to reduce emissions. To

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achieve reductions in our facilities and non-tactical vehicles, DoD is improving its energy management and reducing overall energy use.

The Department of Defense believes that energy management is important for three reasons:

First, increasing energy efficiency reduces the cost of heating our facilities, lighting our workplaces, and cooling our family housing. It thus saves money, which can be applied to other priorities. Second, increasing energy efficiency reduces the fuel required by our trucks, ships and planes and thereby increases their range. Finally, energy conservation is good for the environment, reducing greenhouse gas emissions, as well as those of other pollutants. In sum, sound energy management is good business, makes operational sense, and implements climate change initiatives.

Energy Conservation

In 1992, Congress established important goals and tools for energy conservation in the Federal Government in the Energy Policy Act (EPACT), Public Law 102-486. EPACT required Federal agencies to reduce their energy consumption by 20 percent per square foot by the year 2000 (compared to a 1985 baseline). Additionally, the Act required Federal agencies to undertake all conservation projects by 2005 that pay back in ten years or less. Finally, EPACT established a set of goals to undertake sensible investments in energy and water conservation projects.

In March 1994, President Clinton expanded these objectives in Executive Order 12902 - Energy Efficiency and Water Conservation at Federal Facilities - requiring a 30 percent reduction in per-square-foot energy consumption by 2005 (from the same 1985 baseline).

The Defense Department has been a leader in meeting these targets. While U.S. civilian agencies increased gross energy consumption in buildings and facilities by 13.9 percent from 1985

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through 1996, DoD *decreased* its gross energy consumption by 22.2 percent. During that same period, DoD's total use, measured in terms of net energy consumed per square foot, fell by 15.5 percent. We place a great importance on facility energy reduction because 42 percent of DoD's energy is used in installations and non-tactical vehicles. Energy conservation makes sound business sense for the installation commander, for the Federal Government and for the Nation. Attainment of the 30 percent reduction in per square foot energy consumption by 2005, for example, would result in an annual cost avoidance of approximately \$1 billion. We are not only on the right glide path, we are ahead of it.

Energy Management Achievements

I'd like to tell you about some of the great things our people are doing to conserve energy. Let me give you a few examples that illustrate both their dedication and ingenuity and their potential to achieve even more:

- The USS Essex (LHD-2) consumed 18.3 percent less fuel by overhauling its propulsion auxiliary equipment and aggressively training its personnel in proper maintenance, operation and engineering procedures. The crews sound practices resulted in a savings of 1.2 million gallons of fuel valued at almost \$1 million.
- Last year, our national ground forces training center at Fort Irwin, California, reduced its energy usage by 4 percent, achieving a total net savings of \$425,400. This achievement is all the more significant since it has achieved this same result for four years in a row. Fort Irwin's efforts have made the installation a leader within DoD, having reduced energy consumption by 42 percent compared to the 1985 baseline. To achieve these results, Fort

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Irwin installed lighting retrofits, automatic thermostats with occupant sensors, photovoltaic-powered air sampling systems and ground source heat pumps.

- The Puget Sound Naval Shipyard reduced energy consumption by 7 percent in one year by converting its industrial steam plant from coal to natural gas. It also installed a boiler plant exhaust monitoring system which automatically adjusts the burners to optimize boiler efficiency and minimize carbon dioxide production. Conversion from coal to natural gas also eliminated sulfur dioxide, a significant pollutant and contributor to acid rain, from the exhaust. Combined with savings from spot-market purchases of natural gas, the Shipyard expects to save \$2 million per year from these initiatives with an upfront investment of only \$8.5 million.

Last month, the Department of Energy presented awards for federal energy leadership. This year, as in previous ones, the department of defense won the majority of the awards.

In his recent address on climate change before the National Geographic Society, President Clinton announced a series of initiatives on the part of Federal Agencies. We believe we are leading the way, by:

- *Increasing energy efficiency in new construction.* DoD is working to increase energy efficiency in new construction by 30 percent to 50 percent by fiscal year 2000 (compared to existing facilities). This effort involves: integrating site selection, landscaping and site development to minimize unnecessary heat gain or loss; optimizing architectural design to incorporate local natural conditions such as day-lighting, along with passive or active solar

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applications; and using energy efficient equipment and renewable energy systems. The Services have already executed several projects demonstrating this comprehensive approach. The Naval Facilities Engineering Command's new office spaces in the Washington Navy Yard, for example, incorporate this total design approach. Building energy efficiency into the design added no upfront cost, but will result in annual energy savings of \$130,000 per year (compared to the conventional design originally proposed).

- *Increasing use of energy savings performance contracts (ESPCs).* Energy Savings Performance Contracts use private investment capital and expertise to accomplish energy and cost savings projects in DoD facilities. The contractor's investment is repaid from energy savings resulting from the measures performed at the installation. The energy services contractor typically operates and maintains the equipment installed under an ESPC contract, for a period up to twenty-five years, under terms negotiated with the installation commander. When the investment is repaid, all additional energy savings accrue to the Government, and the Government retains ownership. Recently, the Army Corps of Engineers, as the lead executive agent for the Department, has established two Super Regional ESPCs, together covering all fifty states, with a total investment capacity of \$1.455 billion. Installations can now issue delivery orders against these contracts. Already, the Department has twenty ESPC contracts in progress or under negotiation, with a projected investment by the contractors of nearly \$54.8 million.

Working with the private sector to improve energy efficiency in diesel and high performance turbine engines. The Department is also deeply engaged in research and development

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partnerships with private industry to improve the efficiency of our mobility and weapons systems. The overriding issue for the DoD is reducing the logistics burden, including costs associated with fuel consumption, which will, in turn, reduce emissions of greenhouse gases. Military vehicle propulsion systems are modified commercial models, so we have a direct interest in commercial automotive products and technology. The DoD owns the largest fleet of vehicles within the federal government, the bulk of which are used by the Army. More efficient propulsion systems for a wide range of systems, from medium tactical truck, up to heavy trucks and combat vehicles, would assist the Services in their mission. Because of its central role in advancing dual use automotive technologies, the Army's National Automotive Center located at Warren, Michigan, will take the lead in establishing a consortium of engine manufacturers and research organizations, to include commercial, academic and government laboratories, with the expressed purpose of accelerating technology transfer of advanced diesel engine technologies from research to manufacturing. In concert with the Department of Energy, we have already contacted several leading engine manufacturers to begin such a partnership.

The Integrated High Performance Turbine Engine Technology (IHPTET) program, is another excellent example of the Department's investments in mission-driven technologies designed to maintain future military superiority, which also offers benefits supportive of the Department's broader environmental goals. This highly successful, three-phased program, jointly funded by DoD, NASA, and industry, is designed to develop air breathing gas turbine engine technologies with the goal of doubling propulsion system capability while providing a 40% reduction in fuel burned (through a combination of decreased specific fuel consumption and decreased engine weight). These engines can then be used by the broad spectrum of military aircraft applications. To date, IHPTET has achieved its Phase I goals of a 30% increase in engine thrust-to-weight

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ratio for the turbofan/turbojet family; a 40% increase in power-to-weight ratio and 20% reduction in specific fuel consumption for the turboprop/ turboshaft family; and a 35% increase in thrust-per-unit-airflow and 30% reduction in cost for the expendable engine family; and is well on its way to achieving even more ambitious goals in FY1999.

Long term Impacts of Climate Change on National Security

The climate change treaty protocol is not addressing a theoretical issue, but one that has potentially serious implications for DoD, the United States, and the world. The IPCC, the leading scientific expert today on climate change, has concluded that man made emissions of greenhouse gases are increasing at a rapid rate and predict that as a result, by the year 2100, the global mean surface temperature will increase from 1 - 3.5°C , and average sea level will rise between 15cm and 95cm. These changes will lead to many climate induced impacts that could affect US national security interests.

Today, one billion people around the world live within 60 - 100 kilometers of coastlines with this number almost certain increase by several times within the next two decades. Thirteen of the world's 20 largest cities are located on coasts threatened by a to sea level rise. In addition, an increase in tropical cyclones and hurricanes is predicted within the coming decades, along with marked changes in rainfall patterns, with some regions experiencing more and others less.

Considered on by region, these changes have the potential to create significant political instabilities around the world by threatening food supplies, increasing the frequency and severity of floods and droughts, raising the average sea level globally, and increasing the incidence of

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vector-borne disease. According to the 1990 Intergovernmental Panel on Climate Change (IPCC) Report, "The gravest effects of climate change may be those on human migrations as millions are uprooted by shoreline erosion, coastal flooding, and agricultural disruption".

These events would have significant consequences to future international political stability, and future US defense plans. They could pose real threats to vital US national security interests and lead to conditions similar to those in the past which resulted in US troops being deployed, either for humanitarian or peacekeeping missions, or to protect US security interests. Recent examples include the humanitarian relief effort in Somalia, and the deployment of troops to intercept refugees fleeing Haiti for the US. Inundation of Caribbean islands could create numerous Haiti-type situations, and the predicted agricultural dislocation and flooding in Africa and the Indian Subcontinent could create numerous Somalia-type situations, all occurring simultaneously.

Given the potential threats to international stability from climate induced changes, the Department of Defense fully supports the four key elements of President Clinton's framework for an International Global Climate Change (GCC) Protocol in Kyoto: to commit to the binding and realistic target of returning to 1990 greenhouse gas emission levels between 2008 and 2012; to address all greenhouse gases; to embrace flexible mechanisms for meeting these limits; and to engage both industrialized and developing countries in meeting the challenge of climate change.

SUMMARY

I want to re-emphasize that readiness and the ability to conduct military operations are our highest priority at DoD. We support President Clinton's proposed framework *and* the

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preservation of military operations and readiness which we believe are compatible goals. The Department will continue to be a leader in energy conservation and efficiency, and in reducing greenhouse gas emissions. Reducing energy consumption can be both *financially and* operationally beneficial to the Department, and the Department is committed to pursue such reductions to the extent it is consistent with national security.

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EXECUTIVE OFFICE OF THE PRESIDENT
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WASHINGTON, D.C. 20503

Testimony

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Fax # 86215

To:

Jonathan Ashenk

From:

Bob Treillo

Message:

Katie McGinty's testimony for review and comment
Please get back to me with comments by
5:00 p.m. today.
THANKS

Number of Pages to Follow:

7

Date:

11/5/97

Time:

3:05 pm

Revised Draft 11/04 - 4:35 p.m.

TESTIMONY BEFORE
HOUSE SCIENCE COMMITTEE

by

KATHLEEN A. McGINTY
CHAIR, COUNCIL ON ENVIRONMENTAL QUALITY

NOVEMBER 6, 1997

I am pleased to be here today to describe to this committee the Administration's plan to address the health and environmental risks associated with climate change. We are proposing a comprehensive strategy that creates new opportunities to redirect our use of energy in ways that will be good for both our economy and our environment. The plan creates incentives for the private sector, alone and in partnership with the government, to provide the energy-efficient technologies that will enhance our prosperity, both at home and in the global marketplace, as we move into the next century.

This Committee is a particularly appropriate venue for this discussion because, first and foremost, the issue of climate change starts with the evidence developed by the scientific community. The overwhelming majority of that community has concluded that unless actions are taken to reduce greenhouse gas emissions, at some time in the future we will likely experience unprecedented climatic disruptions.

Over the past several months, the President hosted two sessions where leading scientific and technology experts, economists and business leaders described the current state of knowledge. It was extremely clear from these meetings that, while uncertainties remain, based on what we know today, it would be foolhardy not to begin acting to limit emissions of greenhouse gases.

In responding to this call for action, the President rejected extreme views frequently heard on both sides. He declined the call by some for drastic short-term cuts in emissions that could undermine our continued economic prosperity. At the same time, he rejected those voices urging a "do nothing" approach based on the premise that adverse consequences are the next generation's issue, not ours.

Instead, the President's plan recognizes the challenge of climate change as a tremendous opportunity for heightened economic growth. It challenges our nation's creativity and innovation to reap the benefits from the many win-win opportunities that exist to reduce emissions of greenhouse gases. It is designed to enhance our role as the world's number one economic power by ensuring our continued competitive edge in developing and marketing technologies in an increasingly global marketplace in the 21st century. And in so doing, this policy will protect future generations from having to confront the risks either of severe climatic disruption or of economic dislocations if drastic actions to reduce emissions were to prove necessary at some future time because we failed to begin acting now.

The President's proposal contains both a domestic action plan and an international strategy for dealing with what is fundamentally a global issue. It provides clear instructions to our negotiators involved in talks to strengthen the Framework Convention on Climate Change which are scheduled to conclude in early December of this year in Kyoto, Japan.

The plan was developed following extensive consultations with all interested parties. What the experts - and the economic models - told us is that there are smart ways and dumb ways to address climate change. The President's plan harnesses all of the smart ways: it provides incentives through budget cuts and research and development; it allows for flexibility by proposing budget periods instead of rigid targets for emissions reductions; it taps the power of the marketplace through emissions trading both domestically and internationally; and it recognizes the global nature of the problem by insisting on the participation of all countries.

On the domestic side, the President's plan rejects costly approaches that rely on energy

taxes and heavy-handed regulation. Instead, promotes new business opportunities through tax cuts, R&D incentives and public-private sector partnerships. Further, it allows a decade's worth of experience with these approaches before introducing the emissions trading system that will assure we meet the emissions reduction target.

The plan represents a strong, innovative, yet realistic approach. Not surprisingly it has been attacked by some on both sides of the issue who want either stronger action or no action at all. However, more importantly, it has won the support of a number of firms in the manufacturing and high-tech sectors, as well as energy companies and electric utilities who see this as the best path forward.

On the international side, the President's plan couples a binding, realistic target with proposals that allow countries the flexibility to meet it. The President announced that we would support returning emissions to 1990 levels by the period from 2008 through 2012. This initial step would be followed by further reductions over the next five years. Both here and abroad, during the recent negotiating session, this position has been supported by some, but attacked by many others as being either insufficiently stringent or overly so. It will require the U.S. to reduce emissions in the period 2008-2012 by nearly 30 percent from where they otherwise would be. This represents a substantial, but we believe, realistic challenge and that it is an important first step in safeguarding our nation and the planet against climate change.

The U.S. negotiating position contains several important provisions aimed at providing flexibility for reducing emissions at substantially lower costs. For example, by calling for a five-year budget period, we are seeking to avoid the potential problems inherent in the more traditional single-year target where short-term economic, weather related or energy price influences could make meeting a target more difficult. We have also proposed both emissions trading and joint

implementation with credit for reductions. Both provisions provide incentives for finding and capturing low cost reductions wherever they occur and have the potential for reducing compliance costs by as much as 90 percent. Finally, the U.S. has proposed emissions banking and limited borrowing to allow for cost saving transfers of reductions over time.

The U.S. position also calls for developing countries to play a meaningful role in addressing concerns about global warming. Our position recognizes the need for developed countries to lead the way, but calls on developing countries to play an increasing role as their emissions grow and economic conditions improve over time. Specifically, the U.S. has called for the establishment of a new annex allowing developing countries to agree to take on binding obligations and for agreement by a date certain on a graduation mechanism under which developing countries would take on increasingly stringent provisions over time.

The President stated very clearly that the United States will not take on binding obligations unless key developing meaningfully participate in this effort.

The last major negotiating session concluded in Bonn last week. Based on reports from that meeting, many issues remain to be resolved for an agreement to emerge from Kyoto. While we remain committed to working as hard as we can to make Kyoto a success, we also believe that no agreement in Kyoto would be a better outcome than an agreement that would be bad for our country or one which sets us down a path that would not be sustainable.

Now I would like to return to issues related to domestic implementation and the question of what it will mean for our country to return emissions back to 1990 levels by the period 2008-2012. Let me start by saying categorically it will not mean, as some have suggested, skyrocketing energy prices and wholesale shifts of jobs to developing countries. The President has carefully nurtured our economy back to its strongest point in decades and would not support

any action that would undermine our continued prosperity.

As outlined above, our proposed domestic plan relies extensively on incentives, removing barriers to innovation, partnerships with industry, reinventing federal energy policies, and market-based incentives. During the ten year period prior to 2008, we have proposed the following 9 part plan:

1. Tax Cuts and Research Funding: \$5 billion in tax cuts and expanded federal research and development over five years to spur markets for existing energy efficiency and low-carbon technologies and the creation of even better next generation technologies.
2. Credit for Early Action: to provide immediate incentives for near-term actions by firms and localities able to achieve low cost reductions.
3. Industry by Industry Consultations: The Administration challenges firms to prepare plans over the next 9 months on the most effective ways to reduce greenhouse gas emissions in their sectors.
4. Encouraging the Use of Energy Efficient Products: we are committed to working to remove barriers that exist to expanded markets for existing energy efficient technologies.
5. Federal Procurement and Energy Use: The Department of Energy will spearhead a comprehensive effort to reduce greenhouse gas emissions from federal sources.
6. Electricity Restructuring: To deliver a significant down payment on emissions reductions, while saving consumers billions, we will pursue a bold plan for electricity restructuring that also ensures greenhouse gas reductions and other environmental protection goals.
7. Setting a Concentration Goal: Working with the National Academy of Sciences and other bodies, we will examine issues related to developing a long-term goal for concentrations of greenhouse gases in the atmosphere.
8. Bilateral Dialogues: The President has already had substantive discussions with many world

leaders include those from Argentina, China, the United Kingdom and Japan. Senior officials throughout our government will continue to press the case for the U.S. position at every appropriate opportunity over the coming weeks. Beyond Kyoto, we plan to continue to advance our nation's interests in deploying climate-friendly technology abroad in ways that create environmental and economic benefits for both our national and our international partners.

9. *Economic and Science Reviews:* Recognizing that over time we will learn more about both scientific and economic issues, we will periodically review our policies in light of improved understanding.

Taken together, we believe these actions represent a comprehensive initial step toward reducing our greenhouse gas emissions. This initial stage would be followed by a domestic and international emissions trading regime to meet the binding target beginning in 2008.

We are now beginning the process of moving forward to implement this plan. We will continue to have extensive consultations with interested parties and build on the almost 40 voluntary partnerships between government and the private sector that have been developed over the last several years under the President's Climate Change Action Plan. We welcome your input into these efforts as we move forward in this process.

Testimony

Revised Draft 11/05 - 3:40 p.m.

TESTIMONY BEFORE
HOUSE SCIENCE COMMITTEE

by

KATHLEEN A. McGINTY
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NOVEMBER 6, 1997

I am pleased to be here today to describe the Administration's plan to address the challenges and opportunities presented by climate change. We are proposing a comprehensive strategy that creates new opportunities to redirect our use of energy in ways that will be good for both our economy and our environment. The plan creates incentives for the private sector, alone and in partnership with the government, to provide the energy-efficient technologies that will enhance our prosperity, both at home and in the global marketplace, as we move into the next century.

This Committee is a particularly appropriate venue for this discussion because, first and foremost, the issue of climate change starts with the evidence developed by the scientific community. The overwhelming majority of that community has concluded that unless actions are taken to reduce greenhouse gas emissions, we are likely to experience unprecedented climatic disruptions.

Over the past several months, the Administration conducted extensive public outreach, bringing in leading scientific and technology experts, economists and business leaders to describe the current state of knowledge. It was extraordinarily clear from these meetings that, while uncertainties remain, based on what we know today, it would be foolhardy not to begin acting to limit emissions of greenhouse gases. If we fail to act we risk serious health and environmental consequences. In addition, we risk losing significant opportunities to enhance efficiencies, improve productivity, and capture growing markets for environmentally sound technologies.

In responding to this call for action, the President rejected extreme views frequently heard on both sides. He declined the call by some for drastic short-term cuts in emissions,

because such precipitous action could undermine our continued economic prosperity. At the same time, he rejected those voices urging a "do nothing" approach based on the premise that adverse consequences are the next generation's issue, not ours.

Instead, the President's plan recognizes that the challenge of climate change presents a tremendous opportunity. It challenges our nation's creativity and innovation to reap the benefits from the many win-win opportunities that exist to reduce emissions of greenhouse gases. It is designed to enhance our role as the world's number one economic power by ensuring our continued competitive edge in developing and marketing technologies in an increasingly global marketplace in the 21st century. And in so doing, this policy will protect future generations from having to confront the risks either of severe climatic disruption or of economic dislocations if drastic actions to reduce emissions were to prove necessary at a future time because we failed to begin acting now.

The President's proposal contains both a domestic action plan and an international strategy for dealing with this global issue. It provides clear instructions to our negotiators involved in talks to strengthen the Framework Convention on Climate Change which are scheduled to conclude in early December of this year in Kyoto, Japan.

The plan was developed following extensive consultations with all interested parties. What the experts - and the economic studies - told us is that there are smart ways and dumb ways to address climate change. The President's plan harnesses the smart ways: it provides incentives through tax cuts and investments in research and development; it allows for flexibility by proposing multi-year budget periods instead of rigid one-year targets for emissions reductions; it taps the cost-reducing power of the marketplace through emissions trading both domestically and

internationally; and it recognizes the global nature of the problem by insisting on the participation of all countries.

On the domestic side, the President's plan rejects costly approaches that rely on energy taxes and heavy-handed regulation. Further, it provides for a decade's worth of experience with these approaches before introducing the emissions trading system in 2008 that will assure we meet the emissions reduction target.

The plan represents a strong, innovative, yet realistic approach. Not surprisingly it has been attacked by some on both sides of the issue; those who want either stronger action and by others who want no action at all. It has however won the support of a number of firms in the manufacturing and high-tech sectors (the Business Council for Sustainable Energy), as well as energy companies (e.g. Enron and Trigen Energy Corp.) and electric utilities (Niagra Mohawk, Public Service Electric and Gas) who see this as the best path forward.

This plan builds on a strong foundation of existing public/private partnerships established during the past four years under the President's Climate Change Action Plan. Under this nearly forty largely voluntary programs, over 5,000 big and small companies, public institutions, and state and local governments have committed to actions projected to reduce greenhouse gas emissions by over 150 millions of metric tons of carbon equivalent by 2010 with associated annual energy cost savings of \$50 billion by that year. The President's new plan will substantially expand these efforts as we move into the next century.

On the international side, the President's plan couples a binding, realistic target with

proposals that allow countries the flexibility to meet it. The President announced that we would support returning emissions to 1990 levels by the period from 2008 through 2012. This initial step would be followed by further reductions over the next five years. During the recent negotiating session, this position has drawn support from some countries, but was attacked as insufficient by others. It will require the U.S. to reduce emissions in the period 2008-2012 by nearly 23 percent from where they otherwise would be. This represents a substantial, but we believe, realistic challenge and is an important first step in safeguarding our nation and the planet against climate change.

The U.S. negotiating position contains several important provisions aimed at providing flexibility for reducing emissions at substantially lower costs. For example, by calling for a five-year budget period, we are seeking to avoid the potential problems inherent in the more traditional single-year target where short-term economic, weather related or energy price influences could make meeting a target more difficult. We have also proposed to reduce overall costs through emissions trading and joint implementation with credit. Both provisions provide incentives to find and capture low cost reductions wherever they occur and have the potential for reducing compliance costs by as much as 90 percent. Finally, the U.S. has proposed emissions banking and limited borrowing to allow for cost saving transfers of reductions over time.

The U.S. position also calls for developing countries to play a meaningful role in combating global warming. Our position recognizes the need for developed countries to lead the way, but calls on developing countries to play an increasing role as their emissions grow and economic conditions improve over time. Specifically, the U.S. has called for the establishment of a new annex allowing developing countries to agree to take on binding obligations, and agreement by a date certain on a mechanism under which developing countries would graduate to

increasingly stringent provisions over time.

The President stated very clearly that the United States will not take on binding obligations unless key developing countries meaningfully participate in this effort.

The last major negotiating session prior to the Kyoto meeting concluded in Bonn last week. Many issues remain to be resolved for an agreement to emerge from Kyoto. While we remain committed to working as hard as we can to make Kyoto a success, we also believe that no agreement in Kyoto would be a better outcome than an agreement that would be bad for our country or one which sets us down a path that would not be sustainable.

Now I would like to return to issues related to domestic implementation and the question of what it will mean for our country to return emissions to 1990 levels by the period 2008-2012. Let me start by saying categorically it will not mean, as some have suggested, skyrocketing energy prices and wholesale shifts of jobs to developing countries. The President has carefully nurtured our economy back to its strongest point in decades and would not support any action that would undermine our continued prosperity.

As outlined above, our proposed domestic plan relies extensively on market-based incentives, removing barriers to innovation, establishing partnerships with industry, and reinventing federal energy policies. During the ten year period prior to 2008, we have proposed the following 9 part plan:

1. Tax Cuts and Research Funding: \$5 billion in tax cuts and expanded federal research and development over five years to spur markets for existing energy efficiency and low-carbon technologies and the creation of even better next generation technologies.
2. Credit for Early Action: to provide incentives for near-term actions by firms and localities able to achieve low cost reductions.

3. Industry by Industry Consultations: The Administration challenges firms to work with the Administration to prepare plans over the next 9 months on the most effective ways to reduce greenhouse gas emissions in their sectors.
4. Encouraging the Use of Energy Efficient Products: we are committed to working to remove barriers to expanded markets for existing energy efficient technologies.
5. Federal Procurement and Energy Use: The Department of Energy will spearhead a comprehensive effort to reduce greenhouse gas emissions from federal sources.
6. Electricity Restructuring: To deliver a significant down payment on emissions reductions, while saving consumers billions of dollars, we will pursue a bold plan for electricity restructuring.
7. Setting a Concentration Goal: Working with the National Academy of Sciences and other bodies, we will examine issues related to developing a long-term goal for concentrations of greenhouse gases in the atmosphere.
8. Bilateral Dialogues: The President has already had substantive discussions with many world leaders include those from Argentina, China, the United Kingdom and Japan. Senior officials throughout our government will continue to press the case for the U.S. position at every opportunity over the coming weeks. Beyond Kyoto, we plan to continue to advance our nation's interests in deploying climate-friendly technology abroad in ways that create environmental and economic benefits for both our national and our international partners.
9. Economic and Science Reviews: Recognizing that over time we will learn more about both scientific and economic issues, we will periodically review our policies in light of improved understanding.

Taken together, we believe these actions represent a comprehensive initial step toward

reducing our greenhouse gas emissions. This initial stage would be followed by a domestic and international emissions trading regime to meet the binding target beginning in 2008.

We are now beginning to implement this plan. We will continue to have extensive consultations with interested parties and build on the almost 40 voluntary partnerships between government and the private sector that have been developed over the last several years under the President's Climate Change Action Plan. We welcome your input into these efforts as we move forward in this process.

Testimony

Jonathan

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EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

Tuesday, November 4, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below
FROM: *Ron Peterson*
Ronald K. Peterson (for) Assistant Director for Legislative Reference
OMB CONTACT: Robert J. Tuccillo
PHONE: (202)395-6609 FAX: (202)395-6836
SUBJECT: STATE Oversight Testimony on Global Climate Change

DEADLINE: 8:00 PM Tuesday, November 4, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: If you can not reach Bob Tuccillo, you can also call Susan Wickwire at State at 647-4283.

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SUBJECT: STATE Oversight Testimony on Global Climate Change

If your response to this request for views is short (e.g., concur/no comment), we prefer that you respond by e-mail or by faxing us this response sheet. If the response is short and you prefer to call, please call the branch-wide line shown below (NOT the analyst's line) to leave a message with a legislative assistant.

(1) calling the analyst/attorney's direct line (you will be connected to voice mail if the analyst does not answer); or

(2) sending us a memo or letter

Please include the LAM number shown above, and the subject shown below.

FROM: _____ (Date)
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The following is the response of our agency to your request for views on the above-captioned subject:

_____ Concur
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 _____ No Comment
 _____ See proposed edits on pages _____
 _____ Other: _____
 FAX RETURN of _____ pages, attached to this response sheet

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2002/008

**Statement by Under Secretary for Global Affairs Timothy E. Wirth
before the House Committee on Commerce
November 5, 1997**

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President Clinton's announcement of the U.S. target on October 22 changed the dynamic of the negotiations. His speech marked the beginning of a new effort to undertake realistic and achievable -- yet aggressive -- efforts to reduce greenhouse gas emissions. The enormous technological and innovative capacity of the United States has, with this extraordinary commitment, been channeled to combating the threat of climate change.

In his speech, President Clinton outlined a flexible, market-based and cost-effective approach, backed by a comprehensive domestic program to help meet the ambitious target to return greenhouse gas emissions to 1990 levels in a budget period between 2008 and 2012. This target will be followed by a reduction of all GHG below 1990 levels in the five-year period thereafter, and an effort to make further reductions in the years beyond that. Unlike the EU and others' proposals, the U.S. plan takes a comprehensive view with regard to the gases to be included. We are prepared to address a broad range that includes the "tough" greenhouse gases such as HFCs, PFCs, SF6 and all land use and forest sinks. In real terms, the U.S. commitment is the equivalent of foregoing the anticipated 28 percent growth in U.S. greenhouse gas emissions by the year 2010.

A major element of the President's proposal is the call for both industrialized and developing countries to participate in meeting the challenge of climate change. While developed countries must lead, he insisted that key developing nations must meaningfully participate; otherwise, the United States will not assume binding obligations. Their involvement is vital to addressing the global problem we face: even if the entire industrialized world reduced its emissions significantly over the coming decades, the growing emissions from developing countries will continue to push atmospheric concentrations of greenhouse gases upward. These nations have an opportunity to chart a different energy future.

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The President also placed great emphasis on the need to rely on a series of flexible mechanisms for achieving binding limits. Innovations such as emissions trading and joint implementation with credit will cut worldwide pollution and help developing countries protect their own environments without sacrificing economic growth. The advantages of these mechanisms are obvious: economic analysis and practical experience support them.

Unlike other governments that have announced emissions goals, President Clinton simultaneously announced a domestic program which includes a \$5 billion series of tax incentives and research and development investments to encourage energy efficiency and the use of cleaner energy. He proposed providing incentives for early action by the private sector, with credit for companies that show the way to a lower greenhouse gas future. The President also proposed the creation of a domestic market-based system for reducing emissions -- a system that will tie both our national efforts and the international program into a cost-effective global emissions market. Efforts to change the way the U.S. government buys and uses energy are also included.

Our negotiators worked with other delegates at the Bonn meeting to develop the text for a protocol or other legal instrument for consideration at COP-3 that is consistent with the U.S. proposal. Our negotiators made some important advancements at Bonn including reaching agreement on a number of the compliance provisions. We saw movement in some areas critical to the overall U.S. position, although several important issues within the text remain bracketed. These include sections on emissions trading, joint implementation, "voluntary commitments" by wealthier developing countries, harmonized reduction "policies and measures," multi-year emissions budgets, the treatment of carbon sinks, and the level of target reductions of greenhouse gas emissions by Annex I, as final consensus has not yet been reached on these still contentious points.

Reaching consensus with other negotiating Parties on these issues has been and will continue to be a difficult task: the Group of 77 countries and China worked to block the text in several areas and reintroduced text to reflect its insistence on no new commitments from developing countries, and to obtain new concessions from developed countries on financing and the transfer of "climate-friendly" technologies. Thus, with only a one month until the Conference of the Parties at Kyoto, much work needs to be done on many outstanding and difficult issues.

Yesterday, I met with Environment Ministers from the European Union "Troika." Contrary to perceptions that a wide abyss exists between our positions, I believe that we have begun to coalesce around key issues. When the smoke clears, these differences might not be as great as we previously imagined. Our dialogue served to further understanding of our respective approaches, and we have committed to undertaking intense consultations with the EU over the coming weeks.

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Testimony S

Total Pages: 5

LRM ID: EHF337

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

Tuesday, November 4, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below
FROM: *Ron Peterson*
Ronald K. Peterson (for) Assistant Director for Legislative Reference
OMB CONTACT: Robert J. Tuccillo
PHONE: (202)395-5609 FAX: (202)395-5836

SUBJECT: STATE Oversight Testimony on Global Climate Change

DEADLINE: 6:00 PM Tuesday, November 4, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: If you can not reach Bob Tuccillo, you can also call Susan Wickwire at State at 647-4283.

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LRM ID: EHF337

SUBJECT: STATE Oversight Testimony on Global Climate Change

**RESPONSE TO
LEGISLATIVE REFERRAL
MEMORANDUM**

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You may also respond by:

(1) calling the analyst/attorney's direct line (you will be connected to voice mail if the analyst does not answer); or

(2) sending us a memo or letter

Please include the LRM number shown above, and the subject shown below.

TO:

Robert J. Tuccillo Phone: 395-5609 Fax: 395-5836
Office of Management and Budget
Branch-Wide Line (to reach legislative assistant): 395-4586

FROM:

_____ (Date)
_____ (Name)
_____ (Agency)
_____ (Telephone)

The following is the response of our agency to your request for views on the above-captioned subject:

_____ Concur

_____ No Objection

_____ No Comment

_____ See proposed edits on pages _____

_____ Other: _____

_____ FAX RETURN of _____ pages, attached to this response sheet

Statement by Under Secretary for Global Affairs Timothy E. Wirth
before the House Committee on Commerce
November 5, 1997

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In his speech, President Clinton outlined a flexible, market-based and cost-effective approach, backed by a comprehensive domestic program to help meet the ambitious target to return greenhouse gas emissions to 1990 levels in a budget period between 2008 and 2012. This target will be followed by a reduction of all GHG below 1990 levels in the five-year period thereafter, and an effort to make further reductions in the years beyond that. Unlike the EU and others' proposals, the U.S. plan takes a comprehensive view with regard to the gases to be included. We are prepared to address a broad range that includes the "weight" greenhouse gases such as HFCs, PFCs, SF6 and all land use and forest sinks. In real terms, the U.S. commitment is the equivalent of foregoing the anticipated 28 percent growth in U.S. greenhouse gas emissions by the year 2010.

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If the U.S. continues on
a business as usual path,
emissions would grow
above 1990 levels; thus the Paris
agreement would be undermined

The President also placed great emphasis on the need to rely on a series of flexible mechanisms for achieving binding limits. Innovations such as emissions trading and joint implementation with credit will cut worldwide pollution and help developing countries protect their own environments without sacrificing economic growth. The advantages of these mechanisms are obvious: economic analysis and practical experience support them.

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Testimony
Total Pages: 20

LRM ID: EHF335

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

Tuesday, November 4, 1997

LEGISLATIVE REFERRAL MEMORANDUM

TO: Legislative Liaison Officer - See Distribution below

FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT: Robert J. Tuccillo *or Sarah Harrison 53534*
PHONE: (202)395-5609 FAX: (202)395-5836

SUBJECT: Office of Science and Technology Policy Oversight Testimony on The
Science of Climate Change

DEADLINE: 12:00 NOON Tuesday, November 4, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: Because the hearing is scheduled for 9:30 AM tomorrow, 11/5/97, if your agency does not provide comments by 12:00 Noon today, 11/4/97, this Office will assume that you have no objection to clearance.

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 Office of Management and Budget
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_____ FAX RETURN of _____ pages, attached to this response sheet

Bob T / OMB

Draft JHG Testimony, 11/3/97**Introduction**

Thank you for providing the opportunity to talk to you today about the costs of not acting to control climate change. I'll review the evidence for the changes in atmospheric composition that are occurring now, and the future changes we can expect if we don't take action to reduce emissions of greenhouse gases. I'll also discuss the implications of these changes for socio-economic and ecological systems.

Over the past decade, a series of global environmental changes have been documented in increasing detail. Not only have we demonstrated that climate change, the loss of biodiversity, stratospheric ozone depletion, alteration of the land surface, and changes in the nitrogen balance of the Earth's soils and waters are all occurring and changing the environment on a global-scale, we have also established beyond reasonable doubt that human activities are among the driving forces of such change. We recognize that these changes are interrelated, and that they form a suite of multiple stresses affecting people and the Earth's ecosystems.

The Current Situation

I find the scientific evidence for climate change compelling and this leads me to believe that we need to confront this growing challenge now. It is clear that emissions of greenhouse gases from human activities are enhancing the Earth's natural greenhouse effect, leading to a warming of the planet's surface. It is also clear that this warming will, in turn, lead to a series of further climate disruptions as sea-level rises, patterns of precipitation change, and ideal ranges for plants and animals shift significantly. Climate change is a long-term problem, and solving this problem will require a sustained, long-term effort.

The longer we continue "business as usual," the faster the rate of climate change, the greater the degree of warming, and the more severe the negative effects for human and ecological systems. The sooner we leave the "business as usual" path, the slower the rate of change, the more negative impacts we avoid and the more likely it is that natural systems will be able to adapt to change.

Climate change will force shifts in the range and distribution of many individual plant and animal species, and thus will alter many of the ecosystems, including forests and wetlands that provide the support systems for all life on Earth. If CO₂ concentrations double, fully 1/3 of the forest species worldwide are likely to shift type. In the U.S., sugar maples and beech trees may move completely into Canada, with considerable economic impact. The tourism, maple syrup production, and wood production which are so important to New England's livelihood are at risk. Species that cannot migrate fast or far enough may face extinction. We spend about \$3 billion dollars annually to maintain our parks and refuges as unique assemblages of plants and

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animals. Climate change threatens this substantial national investment. 1/3 of the Everglades may be inundated, 7,000 square miles of coastal lands may be lost, and 50% of recreational brown trout may be lost as waters warm too much to support them. Malaria mosquitoes may be able to survive year-round in much of the US, and drought may become more frequent even as total rainfall and extreme precipitation events increase. Functions such as flood control and purification of air and water can only be provided by intact ecological systems, and when those systems are disrupted or lost we lose the benefits they provide.

The potential cost of such disruption is very serious. A group of ecologists and economists (Costanza et al. in *Nature*) earlier this year produced the first dollar estimate of the value of global ecosystem services -- \$33 trillion annually, nearly twice the global gross national product. It is a conservative estimate based on equilibrium or marginal values -- values for small changes in services from their current values. In a world significantly warmer than today's many ecosystem services would be dearer to us than they are now.

Gretchen Dailey recently edited a book on "Nature's Services" -- not an attempt at comprehensive valuation but, rather, a compilation of efforts to identify and characterize components of ecosystem service value. Her conclusions were: "First, the services operate in intricate and little-explored ways that would be very difficult to substitute for using technology. Their marginal value will therefore almost certainly only go up as their supply dwindles. Second, the total value of ecosystem services is very large. The services examined in this volume amount to many trillions of dollars annually. Third, marginal values of ecosystem services appear high in areas where we have an indication of them. Loss of soil, pest control, pollinators, and ecosystem goods are all presently impoverishing local or regional groups of people. Finally, safeguarding ecosystem services represents one of the wisest economic investments society could make"

Clearly environmental damages from global warming will increase production costs in affected industries and raise the cost of living for us all. Increased evapotranspiration may reduce crop yields and water availability, raising agricultural costs. Agricultural pests and diseases may increase. Higher temperatures may raise air conditioning and cooling costs (though lowering heating bills). Coastal flooding and storm damages may increase due to rising sea levels. The most recent summary of economic impacts of climate change (by Repetto and others at WRI) cites estimates of production losses from a doubling of CO2 concentrations of 1 or 2 percent of GDP. A survey of experts by Bill Nordhaus in 1994 showed a large variation in estimated economic impacts of climate change but unanimity on the point that damage costs increase as the magnitude of climate change increases. The longer we wait to act, the larger that increase will be

For ecosystems, the rate of change may be even more significant than its eventual magnitude. As the distinguished ecologist Professor Jane Lubchenco told the President earlier this year: "The slower the rate of change in climate, the less catastrophic the results. Species are

more likely to be able to migrate, to grow, and evolve if the rate of change is slow." The sooner we reduce emissions, the slower the rate of climate change we can expect.

The Framework Convention on Climate Change, to which the United States is a party, seeks to stabilize atmospheric concentrations at levels that "prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to: (i) allow ecosystems to adapt naturally to climate change; (ii) ensure that food production is not threatened; and (iii) enable economic development to proceed in a sustainable manner." One could argue that the rates of change are already outside that range. Even if emissions were frozen at today's levels, temperatures would rise at about 2 degrees F per century because concentrations would continue to rise. The historical pollen record shows that this rate is about the most that ecosystems could possibly keep up with.

We have already increased atmospheric concentrations of CO₂ thirty percent since the onset of the industrial revolution. To stop at an atmospheric concentration of 550 ppmv of CO₂, which represents about a doubling of pre-industrial levels, reductions in the growth rate of worldwide annual emissions must begin by 2013. That is, the whole world must begin to "apply the brakes" within the next 2 decades, and world emissions must begin declining steeply during the second quarter of the next century.

The results that give us cause for concern come from numerous studies of past climate change, from observations of ecosystems changing over time, and from model simulations that project future conditions. An important aspect of interpreting such results, especially model simulations, is accounting for uncertainty, which is often done in a very selective way by climate change skeptics. Uncertainty cuts both ways: outcomes could be less dramatic than expected based on our current understanding, but could just as well be more severe. We must remember that the current generation of impact projections is focused on a limited number of variables, and that this may result in an overly benign picture of the future. For instance, a series of projections that includes carbon dioxide increases, temperature change, and precipitation changes now indicate that there might be no net effect on global agricultural productivity, although regional dislocations are expected, with the poorest countries experiencing the greatest losses. However, these analyses do not include potential water constraints or changes in the distribution of pests. As the scientists told us at the White House conference October 6, the impacts we have not been able to include are more likely to make the results worse rather than better.

We have not examined the ecological consequences of climate change beyond a doubling of today's concentrations. Yet, if we continue on a "business as usual" path, the Earth's concentrations will soar through that on their way toward a tripling or quadrupling of pre-industrial levels. We will take the planet to levels that have not been seen for 50 million years in a single century, a geological blink of an eye. The Administration has received letters signed by thousands of scientists in the last few months urging action on this issue--warning that nonlinearities or unexpected catastrophic events such as the ozone hole are likely when the rates of change are so fast.

We have received similar letters urging action from the economic community. They point out that paced actions can reduce costs and buy insurance against climate change. It is important to point out that the challenge of climate change poses a tremendous opportunity for American industry. It is absolutely clear that the set of existing energy and agricultural technologies and practices that is the primary cause of global climate change will have to be replaced by a different set of more benign technologies. Technological innovation is the key to our response to the climate challenge, and technological innovation is among America's greatest strengths. Reducing emissions requires development of clean sources of power and more efficient machines, structures, and industrial processes. There will be ancillary benefits of reduced air pollution and increased energy security at the same time. The consequences of our near-term technology choices are significant and long lasting. An appliance or an automobile lasts about 15 years, residential and commercial buildings are designed to last 20-30 years or more and power plants last 30-40 years.

In developing countries alone, there is a \$100 billion annual market in energy supply technologies. Setting emission targets, providing economic incentives, and investing in research will spur the process of innovation and development of cost-effective technologies needed to address this problem and benefit the economy both here and abroad. The longer we continue "business as usual," the longer we delay the development and deployment of technologies that could provide a major competitive advantage to America in the 21st century. The time to begin investment and innovation is now. Let us unleash the power of American ingenuity and entrepreneurship to solve this problem and prove once again that environmental quality and economic prosperity go hand in hand.

The Science of Climate Change

We know that a natural greenhouse effect keeps the Earth's temperature about 60 degrees F warmer than it otherwise would be. Water vapor, CO₂, and other trace gases, such as methane, nitrous oxide, and hydrofluorocarbons (HFCs), trap heat, and keep it from being re-radiated from the Earth back to space. Without this natural warming effect, life as we know it would not be possible.

The problem is that since pre-industrial times, human activities have added to the natural greenhouse effect by releasing additional greenhouse gases into the atmosphere. These emissions have led to a steady increase in the atmospheric concentrations of such gases.

- The atmospheric concentration of carbon dioxide (CO₂) has increased by about 30%.
- Methane concentration has more than doubled.
- Nitrous oxide concentration has risen by 15%.

The burning of fossil fuels (coal, oil, and gas) for energy is the primary source of CO₂ emissions, accounting for about 85% of US annual totals. Emissions of other greenhouse gases from a variety of industrial and agricultural processes effectively add about 20% to these totals. On a

global scale, burning of fossil fuels releases about 6 billion metric tons of carbon into the atmosphere each year. Changing land use patterns through agriculture and deforestation also contributes a significant share, amounting to about another 1-2 billion metric tons per year globally. The rapid rate at which atmospheric concentrations are now increasing is unprecedented.

The increased concentrations of greenhouse gases in the atmosphere trap more heat at the Earth's surface. This means that there is more energy available to the climate system. This extra energy can do two things. It can increase the temperature of the atmosphere, which increases the atmosphere's water holding capacity. Or, where water is available, the heat energy can evaporate water, which is, in fact, where much of the extra energy goes. The result is that the water content of the atmosphere is also increased. The increased water vapor in the atmosphere, in general, produces enhanced amounts and rates of precipitation. In addition, because storms feed on energy and atmospheric moisture, storm duration and size is increased. On the ground, there is likely to be increased runoff and flooding. All of this is based on simple physics.

Implications

So, what does this all mean? Here is some of what we know:

- Without intervention, the level of emissions and concentrations of greenhouse gases will continue to increase, resulting in a variety of global, regional and local effects.
- Global average temperature will rise, although there will be considerable variation in how much temperature increases in specific regions.
- The Earth's water cycle will intensify, with an overall increase in evaporation and transpiration (water loss from plants), as well as precipitation --both rain and snow.
- More precipitation is likely to occur in "extreme" downpours, where large amounts of rain fall in a short period. Some areas will be threatened by increased flooding, while others will suffer through an increased incidence of drought, as continental interiors become warmer and drier.
- Sea level will rise, due primarily to the thermal expansion of the oceans and the melting and retreating of glaciers.

It is very important for you to understand that the changes I am discussing are already taking place. The Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) describes a series of changes that have already been observed:

- Over the last century, the global mean (average) surface temperature increased by about 0.5 - 1° F.
- Over the same period, global mean sea level has already risen 4 to 10 inches.
- Mountain glaciers have retreated worldwide this century.
- The surface temperature this century is as warm or warmer than any century since at least 1400 AD.

- The last few decades have been the warmest in this century, the eleven warmest years this century have all occurred since 1980, and 1995 was the warmest on record.

In addition, the Earth's ecosystems are beginning to react to these changes. A paper published in the April 17, 1997 issue of *Nature* presented compelling evidence for significant regional ecosystem response to warming experienced during the period 1981-1991:

- Over that 10 year period, high latitudes (between 45° and 70° North) sustained a longer growing season, and an advance of up to seven days in "greening" in spring and summer.
- These latitudes appear to be experiencing an increase of approximately 10% in photosynthetic activity, possibly due to the longer growing season, as well as increased CO₂ fertilization.

Precipitation data for the last century show that global precipitation has increased. Change can also be seen in United States precipitation trends. Tom Karl, of the National Oceanic and Atmospheric Administration (NOAA), has reviewed the records of total rainfall and extreme rainfall for the United States over the last century and reached some very interesting conclusions.

- If we look at the record of the last century, we see that U.S. precipitation has increased by an average of 8%. To put this in perspective, this increase is equivalent to the annual amount of water that flows out of the Mississippi River.
- This 8% increase has a lot of regional texture. Some states are suffering from lack of rain, but in many parts of the U.S., the increases have been several times greater than the average. In 1996 alone, six states set "all-time high" records for annual precipitation.
- Furthermore, since the beginning of this century, the frequency of intense precipitation events, where more than two inches of rain falls in a 24-hour period, have increased by about 20%. Such events lead to flooding, soil erosion, and even loss of life.

We know only too well how costly weather disasters can be. Since 1980 we have had 30 weather or climate events with price tags of at least \$1 billion. Nineteen of the events have occurred in the last 5 years. Among the most costly were Hurricane Andrew in 1992 (\$30 billion); the Mid-West floods of 1993 (\$20 billion); 1995's hail storms and floods in Texas, Oklahoma, Louisiana, and Mississippi (\$5.5 billion); the Southern plains drought of 1996 (\$4 billion); and Hurricane Fran in 1996 (\$5 billion). The winter storms that struck the Pacific Northwest this past in December and January are now estimated to have resulted in over \$3 billion in costs and the estimated cost of Northern Plains floods that occurred in April and May of this year is about \$2 billion and still rising.

The costs of such extreme events have doubled or tripled in each of the last few decades. This is partly because our urban and technologically advanced society has become extremely dependent on a massively integrated infrastructure for power, communications, transportation and fresh and wastewater treatment and distribution. This infrastructure is extremely vulnerable

to extreme weather events. I want to emphasize that one can't point to any single extreme weather event today and say for sure that global warming caused it. But we can say that such events are examples of the kinds of impacts we expect to occur with greater frequency in a warmer world. There are likely to be more "storms of the century" and "100-year floods" in the future than there were in the past.

The temperature increases, intensification of the water cycle, and sea-level rise already observed over the past century are all consistent with theoretical predictions of the consequences of an enhanced greenhouse effect. They are also consistent with the projections from simulations of global climate by general circulation models.

The IPCC "business as usual" scenario indicates that even with continued technological improvement, unless policies to control emissions greenhouse gases are implemented, the atmospheric concentrations of these gases will be much higher by 2100. **CO₂ concentrations will reach about 710 parts per million by volume (ppmv), a level higher than any seen on this planet in the last 50 million years.** For context, the pre-industrial level of CO₂ was about 280 ppmv, and has increased to the current level of about 360 ppmv. These increases in are expected to result in significant future climate changes:

- Global surface temperature is projected to increase an average of another 2-6 °F by 2100, with Northern latitudes warming by more. Temperature change of this magnitude would be faster than any observed changes in the last 10,000 years.
- Global mean sea level is projected to rise another 6 to 38 inches by the end of the next century.
- The rate of evaporation is expected to increase as the climate warms, leading to an increase in average global precipitation as well as frequency of intense rainfall and floods in some regions. In some regions, the soil moisture will decrease, leading to increased frequency and intensity of droughts.

Most of the climate impacts have been evaluated for a world at equilibrium after a doubling of greenhouse gases. But stabilizing at doubled greenhouse gas concentrations requires massive intervention. A continuation of "business as usual" implies a world with far higher concentrations and far greater effects. The Geophysical Fluid Dynamics Laboratory at Princeton has recently modeled the effects of doubling and quadrupling the level of greenhouse gases:

- A quadrupling of such concentrations is likely to increase temperatures in North America by 15 - 20° F, as opposed to the 5-10° F expected from doubling.
- In the growing season, soil moisture deficits would approach 30 - 50% for quadrupling, as opposed to 10 - 30 % for doubling.

Although there is scientific uncertainty about exactly how and when the Earth's climate will respond to increased concentrations of greenhouse gases in the future, observations clearly show that detectable changes are underway and that ecological systems are responding to these

changes. Numerous efforts are underway to assess the vulnerability of ecological, social and economic systems to future changes by defining plausible future scenarios of climate change and using model simulations to evaluate sensitivities to various levels and types of change.

Shifting the Focus of the U. S. Global Change Research Program

Until recently, the focus of the U. S. Global Change Research Program (USGCRP) has been on observing and documenting change in the Earth's physical systems and understanding why these changes are occurring. By now, we have demonstrated that climate change as well as the loss of biological diversity, stratospheric ozone depletion, alteration of the land surface, and changes in the nitrogen balance of the Earth's soils and waters, are all modifying the environment on a global-scale, and we have established beyond reasonable doubt that human activities are among the driving forces of such changes. We are also recognizing that these changes are interrelated, and that they form a suite of multiple stresses affecting people and the Earth's ecosystems in numerous ways.

The time has now come to shift the emphasis from a nearly exclusive focus on physical systems to a much more broader effort to understand what global change means for the Earth's biological systems and for the human societies that are dependent upon them. In particular, we want to accomplish two things. First, we need to move from the global to the regional level in seeking to understand what impacts are likely to result from climate change both on its own and in concert with all the other human-induced stresses we are placing on the environment, such as pollution, increasing resource extraction, and non-sustainable management practices. Second, we must now move to approaches that are designed to achieve an integrated understanding not only of the nature and extent of physical and biological effects, but of their ramifications for our social and economic systems.

In the past year, the USGCRP established several new activities. In cooperation with OSTP, the program is sponsoring a series of regional workshops, the purpose of which is to examine the vulnerabilities to climate change and variability that are unique to each area. This information will then be aggregated across regions to support a national-scale assessment of climate change vulnerabilities and impacts, as was called for by the U. S. Global Change Research Act. During 1997, the leaders of our workshops, stakeholders with a broad range of interests, and members of the scientific community have worked together to develop a blueprint for a national assessment process that examines the vulnerabilities of the United States, its ecosystems, major economic system sectors, and its social infrastructure to climate variability and climate change. A National Forum on Climate Change Impacts is being held on November 12-13, in Washington, D.C. to integrate results obtained so far and continue the process of defining the National Assessment. We expect the assessment activity to take place over the next two years, with a major report issued in 1999.

Regional Vulnerabilities in the U.S.

The reports from our regional workshops provide a set of compelling statements on U. S. regional vulnerabilities.

Alaska: The state's economic dependence on natural resources makes it highly vulnerable to climate change. Global warming will be most pronounced in northern regions. Probable consequences include drying of Alaska's interior, inundation of fragile coastal delta areas, and, most seriously, melting of permafrost, which is already underway. Continuation of Alaskan warming will lead to the disappearance of most discontinuous permafrost over the next 100 years. In many places, ground level can collapse 5 yards or more, leading to significant damages to ecosystems and human infrastructure. Houses, roads, airports, military installations, pipelines, and any other facility built on ice-rich permafrost are at risk. The melting of permafrost and the warming of tundra will lead to the release of carbon and methane deposits from the formerly frozen lands, which could make them an additional source of atmospheric greenhouse gases. Ecosystem effects include destruction of trees and caribou habitat; clogging of salmon spawning streams; reduction in forested areas; expansion of lakes and wetlands; and increased rates of coastal and riverbank erosion, slope instability, landslides and erosion.

Pacific Northwest: The dependence of the Northwest on reliable water supplies provides this region's most significant vulnerability to climate change. Model projections indicate that regional consequences of warming are likely to include changing patterns of precipitation and drought, timing of runoff, and increased inundation of coastal areas due to sea level rise. Peak runoff would come earlier in the spring because of more rain and less winter snow. Late winter-early spring flows would be enhanced, increasing the chance of spring flooding. Survival of salmon egg and smolt stages will also be impacted by increased wintertime flows. There would be reduced summer and early fall flow, particularly west of the Cascades Mountain range, due to the warmer, drier summers. This will hurt western salmon migration and spawning. In the Columbia River basin, where an overall decrease in annual run-off is likely, competition among hydropower production, fisheries protection, and irrigation will probably increase. Coastal erosion, landslides and bluff failures are also major risks to ecosystems, urban centers, and coastal development. Existing wetlands will disappear faster than new ones appear, leading to loss of coastal habitat for outmigrating salmon, spawning oceanic species, and mammals and seabirds.

Great Plains: All sectors of life in the Great Plains are dependent on a very limited water supply, and water shortages there are already a problem. The further drying expected from climate change poses the region's most significant risk. Agriculture is the base of the economy, despite the constraints of the dry and variable environment. Because agricultural water needs often exceed rainfall, water for irrigation is commonly supplied from deep aquifers, which are experiencing overdrafts and dropping water tables. As climate change leads to warmer conditions and an intensified hydrological system, the soils of the area are anticipated to further dry. The simultaneous drop in aquifer levels, greater run-off from extreme downpours, and shorter duration of snow cover will exacerbate the region's water supply problems. Drier soils could be subject to increased wind erosion, which has led to "dust bowl" conditions in the past.

Better soil tillage practices would simultaneously improve soil fertility, soil carbon storage capacity, and soil moisture holding capacity. Climate change will disrupt and stress ecosystems and promote opportunities for pest weed invasions. Native species will face increasing levels of competition from introduced species, such as cheat grass, Japanese brome, Russian thistle, and leafy spurge, which already account for extensive economic losses. Riparian areas (wetlands and prairie potholes), which are used intensively by hunters, anglers, and bird watchers, are extremely vulnerable to warmer, drier climate.

Southeast: The Southeast is a region of abundance, with numerous wetlands, an extensive coastline, and productive agriculture, fisheries, and forestry. Urbanization and rapid population growth are already exerting significant stress on some fragile ecosystems. The Florida Everglades have been significantly altered by human encroachment, with approximately half of the ecosystem lost or severely altered by drainage for development as well as pollution from agricultural run-off. While the Southeast's long coastline makes it a recreational playground, its low elevation renders it extremely vulnerable to sea level rise and storm surges during extreme weather events, such as hurricanes, which are expected to worsen with climate change. A 1 foot rise in sea-level could erode 100 to 1000 feet of Florida beaches, damaging property as well as tourist interests.

Southwest: Rapid population growth in this arid or semi-arid region make the Southwest extremely vulnerable to water supply problems that are likely to worsen under climate change. The region is naturally subject to large climate fluctuations, which have produced fairly robust adaptation mechanisms in ranching and agriculture. The native flora and fauna are also well adapted to life in this harsh and dry environment. Surface water supplies are insufficient, forcing reliance on groundwater, use of which already exceeds recharge and is leading to subsidence in many areas. Climate change will pose serious challenges and is likely to result in significant impacts to the region's traditional economic sectors as well as tourism, development, and retail sectors that now make up much of the region's economy. Expected conditions include more extremely hot days, fewer cool days, and decreased winter precipitation. Alteration of the region's hydrologic cycle would affect quantity and quality of the water supply, with major implications for continued development in the region. Increased drought will lead to crop failures, with direct economic losses as well as falling land prices, increased loan defaults, and job losses. Significant changes in vegetation are also predicted, with Gambel oak, Piñon pine, and Douglas fir largely disappearing from the region. Saguaro would die off in its current range, but might find a new home further east and at higher elevations.

New England: New England's economy is diverse, and many aspects are indirectly dependent on climate. Its natural areas are prized, and its fall foliage draws visitors from all over the world. The region is vulnerable to drought and severe storms, which modify its vegetation and impacts production of forest and fisheries products. Warmer, drier climate could reduce ski tourism and shift optimal climatic conditions north into Canada for the tree species prized for their fall foliage and maple syrup. Coastal areas are likely to be affected by intensifying storms, sea level rise, and reduced freshwater input to estuaries. Air quality, already poor in the region's

major urban areas, could decline even further as hot, humid weather increases, leading to increased incidences of respiratory illness.

Sectoral Vulnerabilities and Impacts

An extensive body of research suggests that human health and ecological systems are vulnerable to climate change. The human-induced climate changes that are expected will add important new stresses on ecological and socioeconomic systems that are already affected by pollution, increasing resource extraction, and non-sustainable management practices. The degree of vulnerability, and the amount and rate of change that is experienced in addition to existing stresses will determine the magnitude of climate change impacts.

Many estimates of the effects of climate change are those associated with a doubling of the pre-industrial concentration of CO₂ to approximately 550 ppmv, or an increase in all greenhouse gas concentrations that together would have an equivalent capacity to trap heat. These analyses also assume that the sensitivity of the climate system itself to this change falls in the middle of the range outlined by the IPCC.

The climatic changes that would result from an equivalent doubling of CO₂ would have pervasive effects, some of them irreversible, on ecological systems, human health, and socioeconomic sectors. A lower atmospheric concentration could result in less severe impacts, while a higher concentration would likely have more severe impacts. The following sections describe a range of climate change vulnerabilities and predicted impacts of a doubling of the atmospheric concentrations of greenhouse gases.

Health Effects: According to the World Health Organization, the vulnerability of human populations to climate change varies across populations depending on environmental circumstances, social resources, and preexisting health status. In general, developing countries are more vulnerable to climate change than developed countries because of their limited capital and their greater dependence on natural resources. The elderly and children are the most vulnerable segments of the population. Climate change increases the risk of heat-related mortality and the potential for the spread of vector-borne diseases, such as malaria, dengue and yellow fever, and encephalitis, and non-vector borne diseases such as cholera and salmonellosis. The incidence of infectious diseases, which are still the world's leading cause of fatalities, may also increase.

- A study of deaths associated with summer time heat stress and winter time illnesses in 44 US cities estimated that climate change could double the number of weather-related deaths. The elderly are at greatest risk in the US and urban populations in developing countries are also especially vulnerable to heat stress.
- Climate change is likely to extend the geographic ranges and increase the rates of transmission of disease-carrying vectors such as mosquitoes, which can increase the populations exposed to diseases such as malaria, dengue and yellow fever. Globally, the

population exposed to malaria could increase by one-third. There could be 50-80 million additional malaria cases per year.

- Climate change can reduce air quality and increase levels of air borne pollen and spores, which exacerbate respiratory disease, asthma, and allergic disorders.

Water Resources: Among the most fundamental effects of climate change is an intensification of the hydrological cycle. Changes in precipitation, and increased evaporation and transpiration due to higher temperatures, can be expected to reduce water runoff, affecting the quantity and quality of water supplies for domestic and industrial uses, irrigation, hydropower generation, navigation, stream ecosystems and water based recreation. These affects will vary region by region. Increased variability in the hydrologic cycle is expected to result in more severe droughts and/or floods in some places but less severe in others. Impacts and mitigation expenses for such events are significant; damage estimates from the Mississippi flood of 1993 range from \$10 billion to \$20 billion. Areas of greatest vulnerability are those where water supplies and quality are already problems, such as arid and semi-arid regions of the world and some low lying coastal areas, deltas and small islands.

- Climate change would likely add to the stress in several US river basins, such as the Great Basin, California, Missouri, Arkansas, Texas Gulf, Rio Grande, and Lower Colorado.
- The Colorado River Basin would suffer decreased summer runoff, coinciding with peak demand for irrigation, unless precipitation also increases substantially. Reductions in runoff of up to 25 percent in the basin are projected under some scenarios of doubled CO₂ equivalent climate change.
- Water scarcity in Middle Eastern and African countries also is likely to be exacerbated by climate change. Countries that are highly dependent on water originating in areas outside their borders include Syria, Sudan, Egypt and Iraq.

Forests: One-third of the Earth's forests would undergo a major change in the type of vegetation that could be supported as a result of an equivalent doubling of CO₂. In northern forests, which are the forests most vulnerable to climate change, two-thirds of the currently forested area may undergo a change in vegetation type. Climate change can dramatically alter the geographic distributions of individual tree species and of forest and vegetation types. Mountaintop species and isolated populations are particularly vulnerable. Over the next century, the ideal range for some North American forest species will shift by as much as 300 miles to the north, exceeding the ability of forests and other ecological communities to migrate. In some instances, a change in vegetation type will result in a loss of forest area as the land converts to grassland or shrub land.

- Globally, forested areas may decline 10 percent after forests reach a new equilibrium under a new doubled CO₂ climate.
- In the United States, western conifer forests could decrease in area and be replaced by broadleaf forests; eastern hardwood forests may be replaced by grasslands along their

western boundary because of mid-continental drying. Forest damage from fire and diebacks driven by drought, insects and disease could increase.

Other Natural Areas: Natural ecosystems are highly vulnerable to degradation from climate change. Federally protected natural areas have become a repository for the Nation's rarest species and are critical for the conservation of biological diversity. Nearly \$3 billion is spent annually to manage, maintain, restore, and protect these lands. Climate change may threaten this substantial national investment. The composition, geographic distribution, and productivity of many ecosystems will shift as individual species respond to changes in climate. These will likely lead to reductions in biological diversity and in the goods and services ecosystems provide for society, such as clean water and recreation. Freshwater wetlands are particularly at risk from climate change. IPCC findings show that:

- Precipitation changes and salt water intrusion from sea level rise could adversely affect the ecological communities of the Florida Everglades and degrade the habitat for many species of wading birds.
- The wetlands of the prairie pothole region of North America, which support half the waterfowl population of this continent, could diminish in area and change dramatically in character in response to climate change.

Coastal Areas: Even if concentrations of greenhouse gases are stabilized in the future, sea level would continue to rise long after, perhaps for several centuries, and reach levels much higher than projected for the next 100 years. For example, after an equivalent doubling of CO₂, the IPCC expects sea level to rise by 15 - 95 cm over the next century, with a "best estimate" of 50 cm, but the equilibrium sea level rise several centuries in the future is estimated to be at least 2 meters. Rising sea level erodes beaches and coastal wetlands, causes the gradual inundation of low lying areas, leading to human habitat loss and increasing the vulnerability of coastal areas to flooding from storm surges and intense rainfall. The IPCC estimates that 50 cm of sea level rise would double the population at risk from storm surges, from roughly 45 million at present to over 90 million world-wide. A one-meter rise would triple the number of people exposed. Increases in coastal area populations are likely to further increase the number of people at risk.

- Along US coasts, a 50-cm rise could inundate more than 5000 square miles of dry land and an additional 4000 square miles of wetlands if not protective measures are taken. A 1-meter rise would have greater impact, inundating much of the Southern tip of Florida among other areas.
- Internationally, low-lying areas, such as parts of the Maldives and Bangladesh, would be completely inundated by a 1-meter sea level rise, creating large numbers of environmental refugees, which put stress on governments and social structures. 72 million people in China would be affected, assuming existing levels of coastal development.

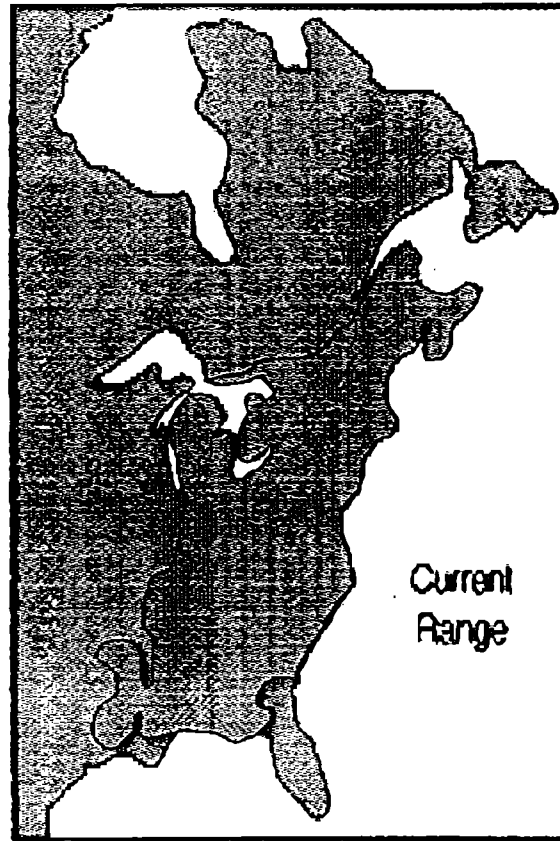
Agriculture and Food Supply: Agriculture is highly dependent on a number of variables that are likely to be affected by climate change, including weather patterns, longer term patterns of climate variability, and, most importantly, water availability. Climate strongly affects crop yields. Doubling of equivalent CO₂ are likely to lead to increased crop yields in many areas, but decreased yields in others, even for the same crop. The magnitude of these changes can exceed +/- 30 or 40 percent for some crops and locations. Despite these potentially large changes in yields, average global food production is not expected to change substantially. This is because farming practices are considered to be highly adaptable to different climates, because production of important food crops can shift to new locations in response to changes in climate, and because CO₂ has beneficial effects for plant photosynthesis and water use efficiency that can offset some deleterious effects of changes in climate. Impacts are likely to vary considerably across regions and some regions may suffer substantial reductions in agricultural production. In general, developing countries are more vulnerable to losses than are developed countries.

- Large reductions in soil moisture could significantly reduce flexibility in crop distribution and increase demands on water resources infrastructure.
- Increases in the range of pest habitat could increase vulnerabilities to pests and demand for, and use of, pesticides.
- In the United States, large areas of the eastern and central regions of the country face moderate to severe drying. Drought could become more frequent, particularly in the Great Plains.

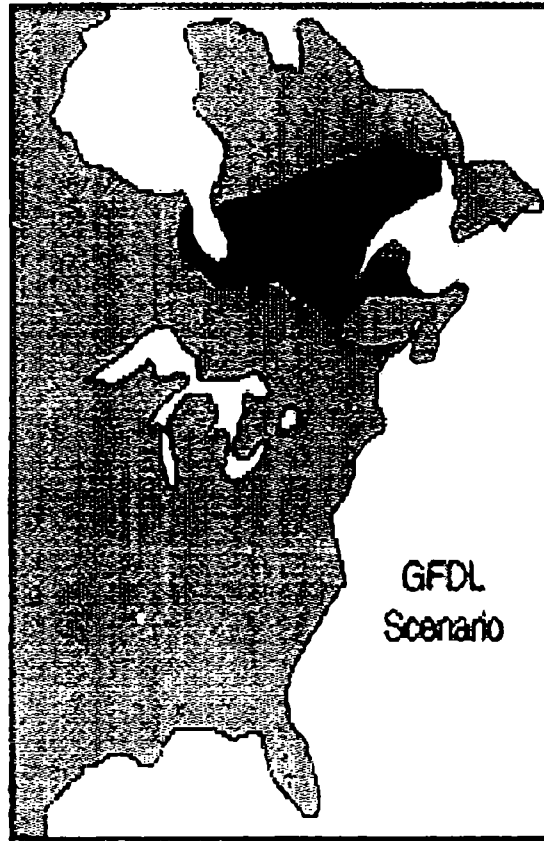
Conclusion:

The rates of change already imposed on the climate system are the faster than any experienced during 10,000 years, during which modern civilization has developed. Current emissions trajectories, if not altered, could take us--before the end of the next century--a moment in history-- to an atmospheric concentration of CO₂ not seen on this planet during the last 50 million years. We cannot preclude some major positive feedback effects--the collapse of the West Antarctic ice sheet which would cause a 15 foot sea-level rise; the stopping of the ocean conveyor belt which could hurl Europe into a deep freeze, or the runaway melting of the Arctic which holds 5 to 7 orders of magnitude more carbon than is in the atmosphere today. While much work remains to be done to improve the precision of impact estimates, the increasingly apparent risk of the rapidly changing atmosphere argues that near-term mitigation and adaptation measures are warranted.

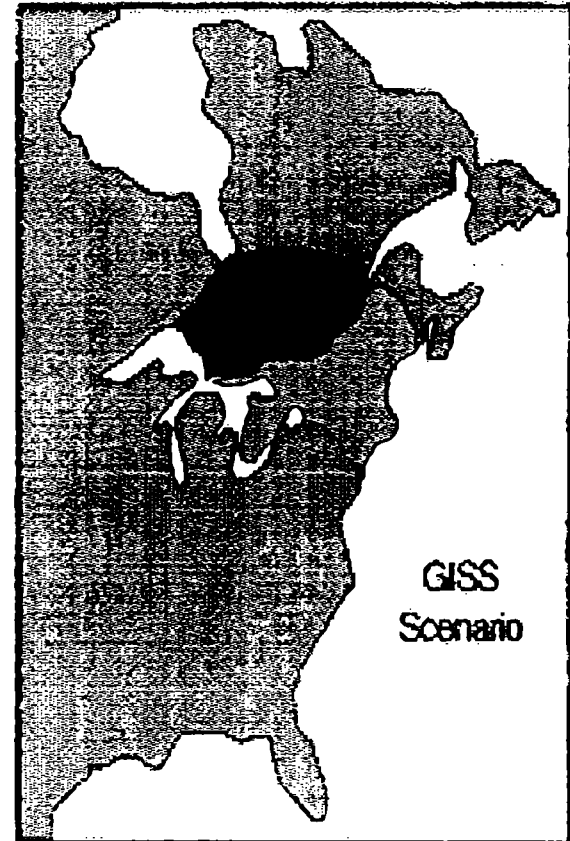
CURRENT AND PROJECTED RANGES OF BEECH TREES IN THE U.S. UNDER TWO MODEL SCENARIOS



Current
Range



GFDL
Scenario



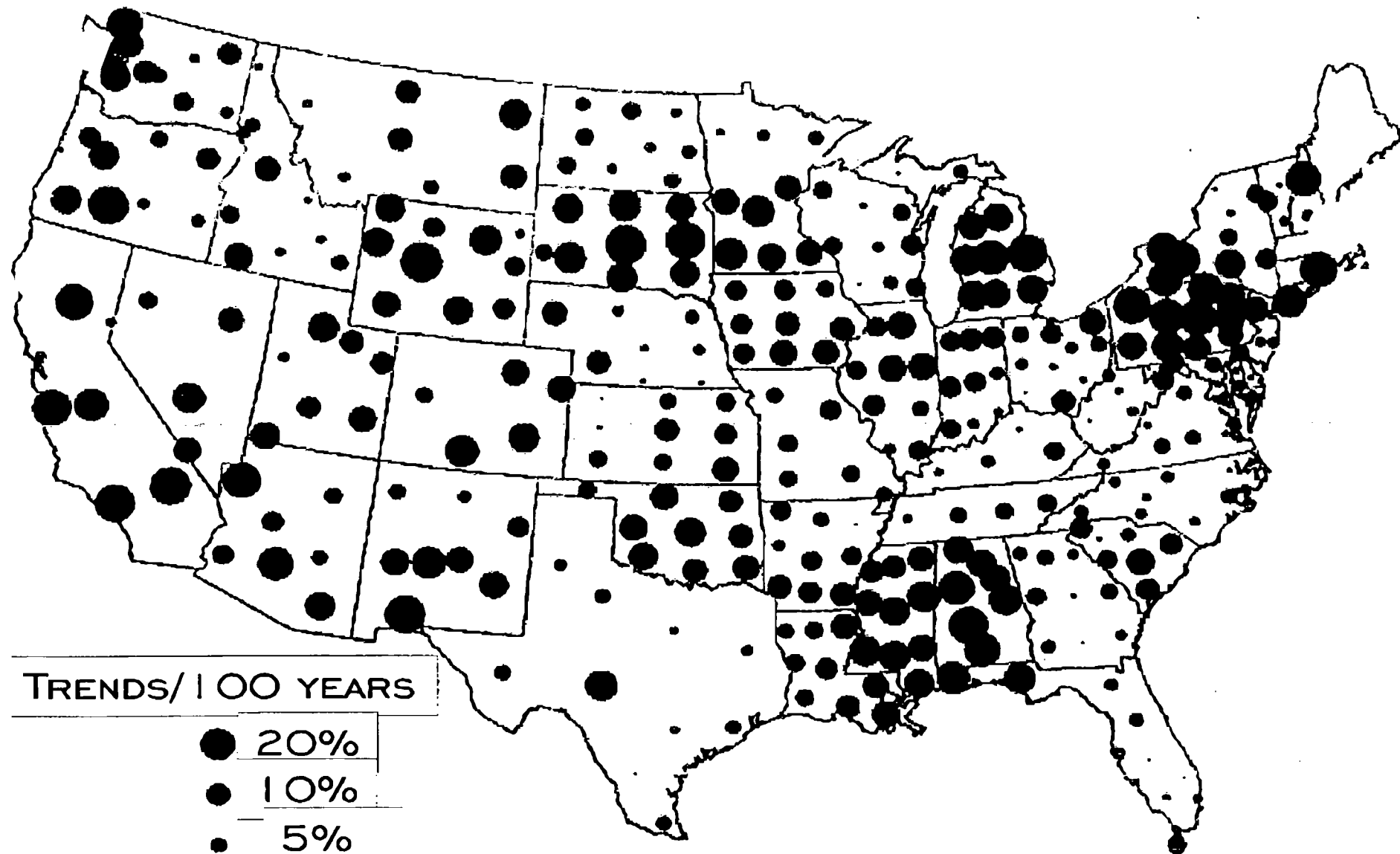
GISS
Scenario



Current Growth



Projected New Growth



Precipitation trends (1990-present, in percent of normal annual precipitation) within state climatic divisions. The diameter of the circle centered within each climatic division reflects the magnitude of the trend. Larger circles have the greater trends. Red reflects increasing precipitation and blue decreasing.

P. 19/20

FROM: FITTER, E.

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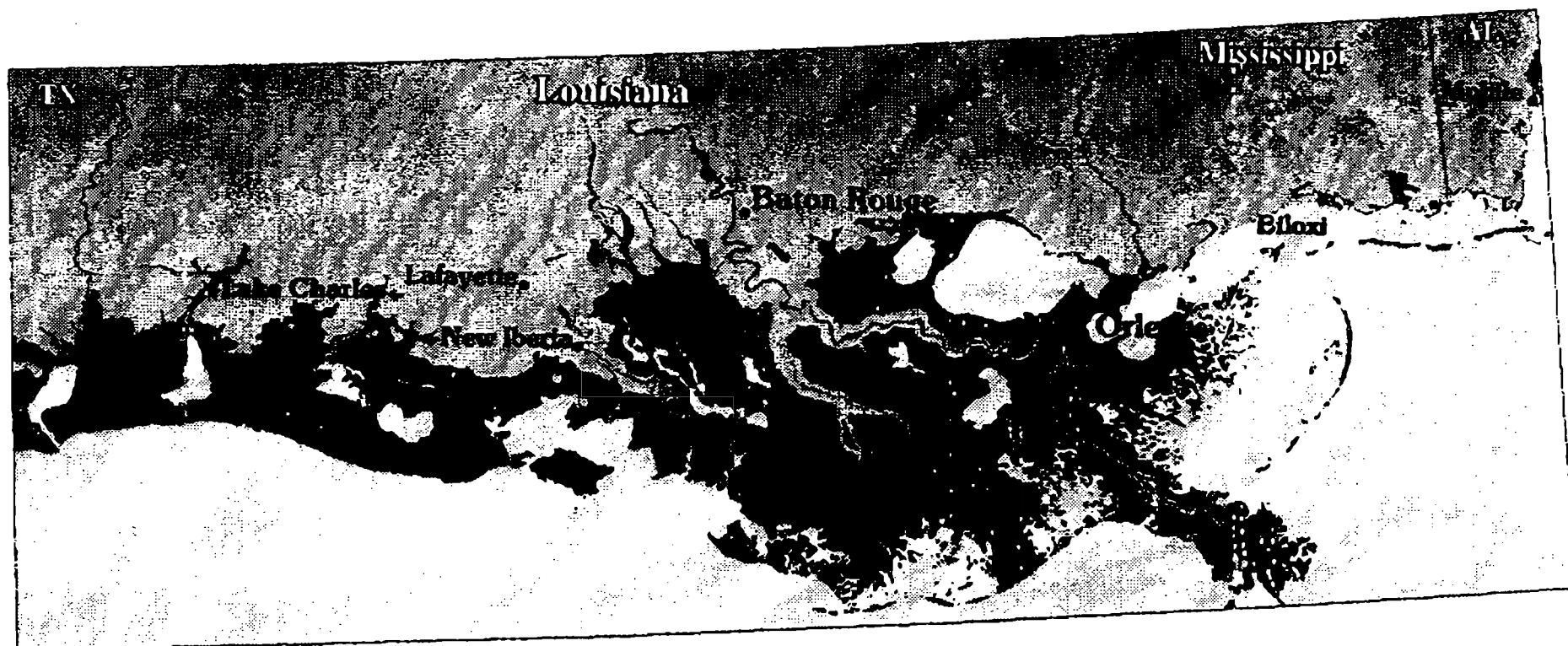
Palmer Drought Severity Index

(1987 through 1996)



Louisiana - Mississippi

Shoreline Change after a 1-Meter Rise in Sea Level



**Areas shown in red are
subject to inundation after
a 1-meter rise in sea level**

Source: Elevations from DOI/USGS digital data

Prepared by the U.S. Geological Survey, 1997

Todd Stern

We decided to put
a lot of stuff on
the record

Draft JHG Testimony, 11/3/97

Introduction

Thank you for providing the opportunity to talk to you today about the costs of not acting to control climate change. I'll review the evidence for the changes in atmospheric composition that are occurring now, and the future changes we can expect if we don't take action to reduce emissions of greenhouse gases. I'll also discuss the implications of these changes for socio-economic and ecological systems.

Over the past decade, a series of global environmental changes have been documented in increasing detail. Not only have we demonstrated that climate change, the loss of biodiversity, stratospheric ozone depletion, alteration of the land surface, and changes in the nitrogen balance of the Earth's soils and waters are all occurring and changing the environment on a global-scale, we have also established beyond reasonable doubt that human activities are among the driving forces of such change. We recognize that these changes are interrelated, and that they form a suite of multiple stresses affecting people and the Earth's ecosystems.

The Current Situation

I find the scientific evidence for climate change compelling and this leads me to believe that we need to confront this growing challenge now. It is clear that emissions of greenhouse gases from human activities are enhancing the Earth's natural greenhouse effect, leading to a warming of the planet's surface. It is also clear that this warming will, in turn, lead to a series of further climate disruptions as sea-level rises, patterns of precipitation change, and ideal ranges for plants and animals shift significantly. Climate change is a long-term problem, and solving this problem will require a sustained, long-term effort.

The longer we continue "business as usual," the faster the rate of climate change, the greater the degree of warming, and the more severe the negative effects for human and ecological systems. The sooner we leave the "business as usual" path, the slower the rate of change, the more negative impacts we avoid and the more likely it is that natural systems will be able to adapt to change.

Climate change will force shifts in the range and distribution of many individual plant and animal species, and thus will alter many of the ecosystems, including forests and wetlands that provide the support systems for all life on Earth. If CO₂ concentrations double, fully 1/3 of the forest species worldwide are likely to shift type. In the U.S., sugar maples and beech trees may move completely into Canada, with considerable economic impact. The tourism, maple syrup production, and wood production which are so important to New England's livelihood are at risk. Species that cannot migrate fast or far enough may face extinction. We spend about \$3 billion dollars annually to maintain our parks and refuges as unique assemblages of plants and

animals. Climate change threatens this substantial national investment. 1/3 of the Everglades may be inundated, 7,000 square miles of coastal lands may be lost, and 50% of recreational brown trout may be lost as waters warm too much to support them. Malaria mosquitoes may be able to survive year-round in much of the US, and drought may become more frequent even as total rainfall and extreme precipitation events increase. Functions such as flood control and purification of air and water can only be provided by intact ecological systems, and when those systems are disrupted or lost we lose the benefits they provide.

The potential cost of such disruption is very serious. A group of ecologists and economists (Costanza et al. in *Nature*) earlier this year produced the first dollar estimate of the value of global ecosystem services -- \$33 trillion annually, nearly twice the global gross national product. It is a conservative estimate based on equilibrium or marginal values -- values for small changes in services from their current values. In a world significantly warmer than today's many ecosystem services would be dearer to us than they are now.

Gretchen Dailey recently edited a book on "Nature's Services" -- not an attempt at comprehensive valuation but, rather, a compilation of efforts to identify and characterize components of ecosystem service value. Her conclusions were: "First, the services operate in intricate and little-explored ways that would be very difficult to substitute for using technology. Their marginal value will therefore almost certainly only go up as their supply dwindles. Second, the total value of ecosystem services is very large. The services examined in this volume amount to many trillions of dollars annually. Third, marginal values of ecosystem services appear high in areas where we have an indication of them. Loss of soil, pest control, pollinators, and ecosystem goods are all presently impoverishing local or regional groups of people. Finally, safeguarding ecosystem services represents one of the wisest economic investments society could make"

Clearly environmental damages from global warming will increase production costs in affected industries and raise the cost of living for us all. Increased evapotranspiration may reduce crop yields and water availability, raising agricultural costs. Agricultural pests and diseases may increase. Higher temperatures may raise air conditioning and cooling costs (though lowering heating bills). Coastal flooding and storm damages may increase due to rising sea levels. The most recent summary of economic impacts of climate change (by Repetto and others at WRI) cites estimates of production losses from a doubling of CO₂ concentrations of 1 or 2 percent of GDP. A survey of experts by Bill Nordhaus in 1994 showed a large variation in estimated economic impacts of climate change but unanimity on the point that damage costs increase as the magnitude of climate change increases. The longer we wait to act, the larger that increase will be

For ecosystems, the rate of change may be even more significant than its eventual magnitude. As the distinguished ecologist Professor Jane Lubchenco told the President earlier this year: "The slower the rate of change in climate, the less catastrophic the results. Species are

more likely to be able to migrate, to grow, and evolve if the rate of change is slow.” The sooner we reduce emissions, the slower the rate of climate change we can expect.

The Framework Convention on Climate Change, to which the United States is a party, seeks to stabilize atmospheric concentrations at levels that “prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to: (I) allow ecosystems to adapt naturally to climate change; (ii) ensure that food production is not threatened; and (iii) enable economic development to proceed in a sustainable manner.” One could argue that the rates of change are already outside that range. Even if emissions were frozen at today’s levels, temperatures would rise at about 2 degrees F per century because concentrations would continue to rise. The historical pollen record shows that this rate is about the most that ecosystems could possibly keep up with.

We have already increased atmospheric concentrations of CO₂ thirty percent since the onset of the industrial revolution. To stop at an atmospheric concentration of 550 ppmv of CO₂, which represents about a doubling of pre-industrial levels, reductions in the growth rate of worldwide annual emissions must begin by 2013. That is, the whole world must begin to “apply the brakes” within the next 2 decades, and world emissions must begin declining steeply during the second quarter of the next century.

The results that give us cause for concern come from numerous studies of past climate change, from observations of ecosystems changing over time, and from model simulations that project future conditions. An important aspect of interpreting such results, especially model simulations, is accounting for uncertainty, which is often done in a very selective way by climate change skeptics. Uncertainty cuts both ways: outcomes could be less dramatic than expected based on our current understanding, but could just as well be more severe. We must remember that the current generation of impact projections is focused on a limited number of variables, and that this may result in an overly benign picture of the future. For instance, a series of projections that includes carbon dioxide increases, temperature change, and precipitation changes now indicate that there might be no net effect on global agricultural productivity, although regional dislocations are expected, with the poorest countries experiencing the greatest losses. However, these analyses do not include potential water constraints or changes in the distribution of pests. As the scientists told us at the White House conference October 6, the impacts we have not been able to include are more likely to make the results worse rather than better.

We have not examined the ecological consequences of climate change beyond a doubling of today’s concentrations. Yet, if we continue on a “business as usual” path, the Earth’s concentrations will soar through that on their way toward a tripling or quadrupling of pre-industrial levels. We will take the planet to levels that have not been seen for 50 million years in a single century, a geological blink of an eye. The Administration has received letters signed by thousands of scientists in the last few months urging action on this issue--warning that nonlinearities or unexpected catastrophic events such as the ozone hole are likely when the rates of change are so fast.

We have received similar letters urging action from the economic community. They point out that paced actions can reduce costs and buy insurance against climate change. It is important to point out that the challenge of climate change poses a tremendous opportunity for American industry. It is absolutely clear that the set of existing energy and agricultural technologies and practices that is the primary cause of global climate change will have to be replaced by a different set of more benign technologies. Technological innovation is the key to our response to the climate challenge, and technological innovation is among America's greatest strengths. Reducing emissions requires development of clean sources of power and more efficient machines, structures, and industrial processes. There will be ancillary benefits of reduced air pollution and increased energy security at the same time. The consequences of our near-term technology choices are significant and long lasting. An appliance or an automobile lasts about 15 years, residential and commercial buildings are designed to last 20-30 years or more and power plants last 30-40 years.

In developing countries alone, there is a \$100 billion annual market in energy supply technologies. Setting emission targets, providing economic incentives, and investing in research will spur the process of innovation and development of cost-effective technologies needed to address this problem and benefit the economy both here and abroad. The longer we continue "business as usual," the longer we delay the development and deployment of technologies that could provide a major competitive advantage to America in the 21st century. The time to begin investment and innovation is now. Let us unleash the power of American ingenuity and entrepreneurship to solve this problem and prove once again that environmental quality and economic prosperity go hand in hand.

The Science of Climate Change

We know that a natural greenhouse effect keeps the Earth's temperature about 60 degrees F warmer than it otherwise would be. Water vapor, CO₂, and other trace gases, such as methane, nitrous oxide, and hydrofluorocarbons (HFCs), trap heat, and keep it from being re-radiated from the Earth back to space. Without this natural warming effect, life as we know it would not be possible.

The problem is that since pre-industrial times, human activities have added to the natural greenhouse effect by releasing additional greenhouse gases into the atmosphere. These emissions have led to a steady increase in the atmospheric concentrations of such gases.

- The atmospheric concentration of carbon dioxide (CO₂) has increased by about 30%.
- Methane concentration has more than doubled.
- Nitrous oxide concentration has risen by 15%.

The burning of fossil fuels (coal, oil, and gas) for energy is the primary source of CO₂ emissions, accounting for about 85% of US annual totals. Emissions of other greenhouse gases from a variety of industrial and agricultural processes effectively add about 20% to these totals. On a

global scale, burning of fossil fuels releases about 6 billion metric tons of carbon into the atmosphere each year. Changing land use patterns through agriculture and deforestation also contributes a significant share, amounting to about another 1-2 billion metric tons per year globally. The rapid rate at which atmospheric concentrations are now increasing is unprecedented.

The increased concentrations of greenhouse gases in the atmosphere trap more heat at the Earth's surface. This means that there is more energy available to the climate system. This extra energy can do two things. It can increase the temperature of the atmosphere, which increases the atmosphere's water holding capacity. Or, where water is available, the heat energy can evaporate water, which is, in fact, where much of the extra energy goes. The result is that the water content of the atmosphere is also increased. The increased water vapor in the atmosphere, in general, produces enhanced amounts and rates of precipitation. In addition, because storms feed on energy and atmospheric moisture, storm duration and size is increased. On the ground, there is likely to be increased runoff and flooding. All of this is based on simple physics.

Implications

So, what does this all mean? Here is some of what we know:

- Without intervention, the level of emissions and concentrations of greenhouse gases will continue to increase, resulting in a variety of global, regional and local effects.
- Global average temperature will rise, although there will be considerable variation in how much temperature increases in specific regions.
- The Earth's water cycle will intensify, with an overall increase in evaporation and transpiration (water loss from plants), as well as precipitation --both rain and snow.
- More precipitation is likely to occur in "extreme" downpours, where large amounts of rain fall in a short period. Some areas will be threatened by increased flooding, while others will suffer through an increased incidence of drought, as continental interiors become warmer and drier.
- Sea level will rise, due primarily to the thermal expansion of the oceans and the melting and retreating of glaciers.

It is very important for you to understand that the changes I am discussing are already taking place. The Second Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) describes a series of changes that have already been observed:

- Over the last century, the global mean (average) surface temperature increased by about 0.5 - 1° F.
- Over the same period, global mean sea level has already risen 4 to 10 inches.
- Mountain glaciers have retreated worldwide this century.
- The surface temperature this century is as warm or warmer than any century since at least 1400 AD.

- The last few decades have been the warmest in this century, the eleven warmest years this century have all occurred since 1980, and 1995 was the warmest on record.

In addition, the Earth's ecosystems are beginning to react to these changes. A paper published in the April 17, 1997 issue of *Nature* presented compelling evidence for significant regional ecosystem response to warming experienced during the period 1981-1991:

- Over that 10 year period, high latitudes (between 45° and 70° North) sustained a longer growing season, and an advance of up to seven days in "greening" in spring and summer,
- These latitudes appear to be experiencing an increase of approximately 10% in photosynthetic activity, possibly due to the longer growing season, as well as increased CO₂ fertilization.

Precipitation data for the last century show that global precipitation has increased. Change can also be seen in United States precipitation trends. Tom Karl, of the National Oceanic and Atmospheric Administration (NOAA), has reviewed the records of total rainfall and extreme rainfall for the United States over the last century and reached some very interesting conclusions.

- If we look at the record of the last century, we see that U.S. precipitation has increased by an average of 8%. To put this in perspective, this increase is equivalent to the annual amount of water that flows out of the Mississippi River.
- This 8% increase has a lot of regional texture. Some states are suffering from lack of rain, but in many parts of the U.S., the increases have been several times greater than the average. In 1996 alone, six states set "all-time high" records for annual precipitation.
- Furthermore, since the beginning of this century, the frequency of intense precipitation events, where more than two inches of rain falls in a 24-hour period, have increased by about 20%. Such events lead to flooding, soil erosion, and even loss of life.

We know only too well how costly weather disasters can be. Since 1980 we have had 30 weather or climate events with price tags of at least \$1 billion. Nineteen of the events have occurred in the last 5 years. Among the most costly were Hurricane Andrew in 1992 (\$30 billion); the Mid-West floods of 1993 (\$20 billion); 1995's hail storms and floods in Texas, Oklahoma, Louisiana, and Mississippi (\$5.5 billion); the Southern plains drought of 1996 (\$4 billion); and Hurricane Fran in 1996 (\$5 billion). The winter storms that struck the Pacific Northwest this past in December and January are now estimated to have resulted in over \$3 billion in costs and the estimated cost of Northern Plains floods that occurred in April and May of this year is about \$2 billion and still rising.

The costs of such extreme events have doubled or tripled in each of the last few decades. This is partly because our urban and technologically advanced society has become extremely dependent on a massively integrated infrastructure for power, communications, transportation and fresh and wastewater treatment and distribution. This infrastructure is extremely vulnerable

to extreme weather events. I want to emphasize that one can't point to any single extreme weather event today and say for sure that global warming caused it. But we can say that such events are examples of the kinds of impacts we expect to occur with greater frequency in a warmer world. There are likely to be more "storms of the century" and "100-year floods" in the future than there were in the past.

The temperature increases, intensification of the water cycle, and sea-level rise already observed over the past century are all consistent with theoretical predictions of the consequences of an enhanced greenhouse effect. They are also consistent with the projections from simulations of global climate by general circulation models.

The IPCC "business as usual" scenario indicates that even with continued technological improvement, unless policies to control emissions greenhouse gases are implemented, the atmospheric concentrations of these gases will be much higher by 2100. **CO₂ concentrations will reach about 710 parts per million by volume (ppmv), a level higher than any seen on this planet in the last 50 million years.** For context, the pre-industrial level of CO₂ was about 280 ppmv, and has increased to the current level of about 360 ppmv. These increases in are expected to result in significant future climate changes:

- Global surface temperature is projected to increase an average of another 2-6 °F by 2100, with Northern latitudes warming by more. Temperature change of this magnitude would be faster than any observed changes in the last 10,000 years.
- Global mean sea level is projected to rise another 6 to 38 inches by the end of the next century.
- The rate of evaporation is expected to increase as the climate warms, leading to an increase in average global precipitation as well as frequency of intense rainfall and floods in some regions. In some regions, the soil moisture will decrease, leading to increased frequency and intensity of droughts.

Most of the climate impacts have been evaluated for a world at equilibrium after a doubling of greenhouse gases. But stabilizing at doubled greenhouse gas concentrations requires massive intervention. A continuation of "business as usual" implies a world with far higher concentrations and far greater effects. The Geophysical Fluid Dynamics Laboratory at Princeton has recently modeled the effects of doubling and quadrupling the level of greenhouse gases:

- A quadrupling of such concentrations is likely to increase temperatures in North America by 15 - 20° F, as opposed to the 5-10° F expected from doubling.
- In the growing season, soil moisture deficits would approach 30 - 50% for quadrupling, as opposed to 10 - 30 % for doubling.

Although there is scientific uncertainty about exactly how and when the Earth's climate will respond to increased concentrations of greenhouse gases in the future, observations clearly show that detectable changes are underway and that ecological systems are responding to these

changes. Numerous efforts are underway to assess the vulnerability of ecological, social and economic systems to future changes by defining plausible future scenarios of climate change and using model simulations to evaluate sensitivities to various levels and types of change.

Shifting the Focus of the U. S. Global Change Research Program

Until recently, the focus of the U. S. Global Change Research Program (USGCRP) has been on observing and documenting change in the Earth's physical systems and understanding why these changes are occurring. By now, we have demonstrated that climate change as well as the loss of biological diversity, stratospheric ozone depletion, alteration of the land surface, and changes in the nitrogen balance of the Earth's soils and waters, are all modifying the environment on a global-scale, and we have established beyond reasonable doubt that human activities are among the driving forces of such changes. We are also recognizing that these changes are interrelated, and that they form a suite of multiple stresses affecting people and the Earth's ecosystems in numerous ways.

The time has now come to shift the emphasis from a nearly exclusive focus on physical systems to a much more broader effort to understand what global change means for the Earth's biological systems and for the human societies that are dependent upon them. In particular, we want to accomplish two things. First, we need to move from the global to the regional level in seeking to understand what impacts are likely to result from climate change both on its own and in concert with all the other human-induced stresses we are placing on the environment, such as pollution, increasing resource extraction, and non-sustainable management practices. Second, we must now move to approaches that are designed to achieve an integrated understanding not only of the nature and extent of physical and biological effects, but of their ramifications for our social and economic systems.

In the past year, the USGCRP established several new activities. In cooperation with OSTP, the program is sponsoring a series of regional workshops, the purpose of which is to examine the vulnerabilities to climate change and variability that are unique to each area. This information will then be aggregated across regions to support a national-scale assessment of climate change vulnerabilities and impacts, as was called for by the U. S. Global Change Research Act. During 1997, the leaders of our workshops, stakeholders with a broad range of interests, and members of the scientific community have worked together to develop a blueprint for a national assessment process that examines the vulnerabilities of the United States, its ecosystems, major economic system sectors, and its social infrastructure to climate variability and climate change. A National Forum on Climate Change Impacts is being held on November 12-13, in Washington, D.C. to integrate results obtained so far and continue the process of defining the National Assessment. We expect the assessment activity to take place over the next two years, with a major report issued in 1999.

Regional Vulnerabilities in the U.S.

The reports from our regional workshops provide a set of compelling statements on U. S. regional vulnerabilities.

Alaska: The state's economic dependence on natural resources makes it highly vulnerable to climate change. Global warming will be most pronounced in northern regions. Probable consequences include drying of Alaska's interior, inundation of fragile coastal delta areas, and, most seriously, melting of permafrost, which is already underway. Continuation of Alaskan warming will lead to the disappearance of most discontinuous permafrost over the next 100 years. In many places, ground level can collapse 5 yards or more, leading to significant damages to ecosystems and human infrastructure. Houses, roads, airports, military installations, pipelines, and any other facility built on ice-rich permafrost are at risk. The melting of permafrost and the warming of tundra will lead to the release of carbon and methane deposits from the formerly frozen lands, which could make them an additional source of atmospheric greenhouse gases. Ecosystem effects include destruction of trees and caribou habitat; clogging of salmon spawning streams; reduction in forested areas; expansion of lakes and wetlands; and increased rates of coastal and riverbank erosion, slope instability, landslides and erosion.

Pacific Northwest: The dependence of the Northwest on reliable water supplies provides this region's most significant vulnerability to climate change. Model projections indicate that regional consequences of warming are likely to include changing patterns of precipitation and drought, timing of runoff, and increased inundation of coastal areas due to sea level rise. Peak runoff would come earlier in the spring because of more rain and less winter snow. Late winter-early spring flows would be enhanced, increasing the chance of spring flooding. Survival of salmon egg and smolt stages will also be impacted by increased wintertime flows. There would be reduced summer and early fall flow, particularly west of the Cascades Mountain range, due to the warmer, drier summers. This will hurt western salmon migration and spawning. In the Columbia River basin, where an overall decrease in annual run-off is likely, competition among hydropower production, fisheries protection, and irrigation will probably increase. Coastal erosion, landslides and bluff failures are also major risks to ecosystems, urban centers, and coastal development. Existing wetlands will disappear faster than new ones appear, leading to loss of coastal habitat for outmigrating salmon, spawning oceanic species, and mammals and seabirds.

Great Plains: All sectors of life in the Great Plains are dependent on a very limited water supply, and water shortages there are already a problem. The further drying expected from climate change poses the region's most significant risk. Agriculture is the base of the economy, despite the constraints of the dry and variable environment. Because agricultural water needs often exceed rainfall, water for irrigation is commonly supplied from deep aquifers, which are experiencing overdrafts and dropping water tables. As climate change leads to warmer conditions and an intensified hydrological system, the soils of the area are anticipated to further dry. The simultaneous drop in aquifer levels, greater run-off from extreme downpours, and shorter duration of snow cover will exacerbate the region's water supply problems. Drier soils could be subject to increased wind erosion, which has led to "dust bowl" conditions in the past.

Better soil tillage practices would simultaneously improve soil fertility, soil carbon storage capacity, and soil moisture holding capacity. Climate change will disrupt and stress ecosystems and promote opportunities for pest weed invasions. Native species will face increasing levels of competition from introduced species, such as cheat grass, Japanese brome, Russian thistle, and leafy spurge, which already account for extensive economic losses. Riparian areas (wetlands and prairie potholes), which are used intensively by hunters, anglers, and bird watchers, are extremely vulnerable to warmer, drier climate.

Southeast: The Southeast is a region of abundance, with numerous wetlands, an extensive coastline, and productive agriculture, fisheries, and forestry. Urbanization and rapid population growth are already exerting significant stress on some fragile ecosystems. The Florida Everglades have been significantly altered by human encroachment, with approximately half of the ecosystem lost or severely altered by drainage for development as well as pollution from agricultural run-off. While the Southeast's long coastline makes it a recreational playground, its low elevation renders it extremely vulnerable to sea level rise and storm surges during extreme weather events, such as hurricanes, which are expected to worsen with climate change. A 1 foot rise in sea-level could erode 100 to 1000 feet of Florida beaches, damaging property as well as tourist interests.

Southwest: Rapid population growth in this arid or semi-arid region make the Southwest extremely vulnerable to water supply problems that are likely to worsen under climate change. The region is naturally subject to large climate fluctuations, which have produced fairly robust adaptation mechanisms in ranching and agriculture. The native flora and fauna are also well adapted to life in this harsh and dry environment. Surface water supplies are insufficient; forcing reliance on groundwater, use of which already exceeds recharge and is leading to subsidence in many areas. Climate change will pose serious challenges and is likely to result in significant impacts to the region's traditional economic sectors as well as tourism, development, and retail sectors that now make up much of the region's economy. Expected conditions include more extremely hot days, fewer cool days, and decreased winter precipitation. Alteration of the region's hydrologic cycle would affect quantity and quality of the water supply, with major implications for continued development in the region. Increased drought will lead to crop failures, with direct economic losses as well as falling land prices, increased loan defaults, and job losses. Significant changes in vegetation are also predicted, with Gambel oak, Piñon pine, and Douglas fir largely disappearing from the region. Saguaro would die off in its current range, but might find a new home further east and at higher elevations.

New England: New England's economy is diverse, and many aspects are indirectly dependent on climate. Its natural areas are prized, and its fall foliage draws visitors from all over the world. The region is vulnerable to drought and severe storms, which modify its vegetation and impacts production of forest and fisheries products. Warmer, drier climate could reduce ski tourism and shift optimal climatic conditions north into Canada for the tree species prized for their fall foliage and maple syrup. Coastal areas are likely to be affected by intensifying storms, sea level rise, and reduced freshwater input to estuaries. Air quality, already poor in the region's

major urban areas, could decline even further as hot, humid weather increases, leading to increased incidences of respiratory illness.

Sectoral Vulnerabilities and Impacts

An extensive body of research suggests that human health and ecological systems are vulnerable to climate change. The human-induced climate changes that are expected will add important new stresses on ecological and socioeconomic systems that are already affected by pollution, increasing resource extraction, and non-sustainable management practices. The degree of vulnerability, and the amount and rate of change that is experienced in addition to existing stresses will determine the magnitude of climate change impacts.

Many estimates of the effects of climate change are those associated with a doubling of the pre-industrial concentration of CO₂ to approximately 550 ppmv, or an increase in all greenhouse gas concentrations that together would have an equivalent capacity to trap heat. These analyses also assume that the sensitivity of the climate system itself to this change falls in the middle of the range outlined by the IPCC.

The climatic changes that would result from an equivalent doubling of CO₂ would have pervasive effects, some of them irreversible, on ecological systems, human health, and socioeconomic sectors. A lower atmospheric concentration could result in less severe impacts, while a higher concentration would likely have more severe impacts. The following sections describe a range of climate change vulnerabilities and predicted impacts of a doubling of the atmospheric concentrations of greenhouse gases.

Health Effects: According to the World Health Organization, the vulnerability of human populations to climate change varies across populations depending on environmental circumstances, social resources, and preexisting health status. In general, developing countries are more vulnerable to climate change than developed countries because of their limited capital and their greater dependence on natural resources. The elderly and children are the most vulnerable segments of the population. Climate change increases the risk of heat-related mortality and the potential for the spread of vector-borne diseases, such as malaria, dengue and yellow fever, and encephalitis, and non-vector borne diseases such as cholera and salmonellosis. The incidence of infectious diseases, which are still the world's leading cause of fatalities, may also increase.

- A study of deaths associated with summer time heat stress and winter time illnesses in 44 US cities estimated that climate change could double the number of weather-related deaths. The elderly are at greatest risk in the US and urban populations in developing countries are also especially vulnerable to heat stress.
- Climate change is likely to extend the geographic ranges and increase the rates of transmission of disease-carrying vectors such as mosquitoes, which can increase the populations exposed to diseases such as malaria, dengue and yellow fever. Globally, the

population exposed to malaria could increase by one-third. There could be 50-80 million additional malaria cases per year.

- Climate change can reduce air quality and increase levels of air borne pollen and spores, which exacerbate respiratory disease, asthma, and allergic disorders.

Water Resources: Among the most fundamental effects of climate change is an intensification of the hydrological cycle. Changes in precipitation, and increased evaporation and transpiration due to higher temperatures, can be expected to reduce water runoff, affecting the quantity and quality of water supplies for domestic and industrial uses, irrigation, hydropower generation, navigation, stream ecosystems and water based recreation. These affects will vary region by region. Increased variability in the hydrologic cycle is expected to result in more severe droughts and/or floods in some places but less severe in others. Impacts and mitigation expenses for such events are significant; damage estimates from the Mississippi flood of 1993 range from \$10 billion to \$20 billion. Areas of greatest vulnerability are those where water supplies and quality are already problems, such as arid and semi-arid regions of the world and some low lying coastal areas, deltas and small islands.

- Climate change would likely add to the stress in several US river basins, such as the Great Basin, California, Missouri, Arkansas, Texas Gulf, Rio Grande, and Lower Colorado.
- The Colorado River Basin would suffer decreased summer runoff, coinciding with peak demand for irrigation, unless precipitation also increases substantially. Reductions in runoff of up to 25 percent in the basin are projected under some scenarios of doubled CO₂ equivalent climate change.
- Water scarcity in Middle Eastern and African countries also is likely to be exacerbated by climate change. Countries that are highly dependent on water originating in areas outside their borders include Syria, Sudan, Egypt and Iraq.

Forests: One-third of the Earth's forests would undergo a major change in the type of vegetation that could be supported as a result of an equivalent doubling of CO₂. In northern forests, which are the forests most vulnerable to climate change, two-thirds of the currently forested area may undergo a change in vegetation type. Climate change can dramatically alter the geographic distributions of individual tree species and of forest and vegetation types. Mountaintop species and isolated populations are particularly vulnerable. Over the next century, the ideal range for some North American forest species will shift by as much as 300 miles to the north, exceeding the ability of forests and other ecological communities to migrate. In some instances, a change in vegetation type will result in a loss of forest area as the land converts to grassland or shrub land.

- Globally, forested areas may decline 10 percent after forests reach a new equilibrium under a new doubled CO₂ climate.
- In the United States, western conifer forests could decrease in area and be replaced by broadleaf forests; eastern hardwood forests may be replaced by grasslands along their

western boundary because of mid-continental drying. Forest damage from fire and diebacks driven by drought, insects and disease could increase.

Other Natural Areas: Natural ecosystems are highly vulnerable to degradation from climate change. Federally protected natural areas have become a repository for the Nation's rarest species and are critical for the conservation of biological diversity. Nearly \$3 billion is spent annually to manage, maintain, restore, and protect these lands. Climate change may threaten this substantial national investment. The composition, geographic distribution, and productivity of many ecosystems will shift as individual species respond to changes in climate. These will likely lead to reductions in biological diversity and in the goods and services ecosystems provide for society, such as clean water and recreation. Freshwater wetlands are particularly at risk from climate change. IPCC findings show that:

- Precipitation changes and salt water intrusion from sea level rise could adversely affect the ecological communities of the Florida Everglades and degrade the habitat for many species of wading birds.
- The wetlands of the prairie pothole region of North America, which support half the waterfowl population of this continent, could diminish in area and change dramatically in character in response to climate change.

Coastal Areas: Even if concentrations of greenhouse gases are stabilized in the future, sea level would continue to rise long after, perhaps for several centuries, and reach levels much higher than projected for the next 100 years. For example, after an equivalent doubling of CO₂, the IPCC expects sea level to rise by 15 - 95 cm over the next century, with a "best estimate" of 50 cm, but the equilibrium sea level rise several centuries in the future is estimated to be at least 2 meters. Rising sea level erodes beaches and coastal wetlands, causes the gradual inundation of low lying areas, leading to human habitat loss and increasing the vulnerability of coastal areas to flooding from storm surges and intense rainfall. The IPCC estimates that 50 cm of sea level rise would double the population at risk from storm surges, from roughly 45 million at present to over 90 million world-wide. A one-meter rise would triple the number of people exposed. Increases in coastal area populations are likely to further increase the number of people at risk.

- Along US coasts, a 50-cm rise could inundate more than 5000 square miles of dry land and an additional 4000 square miles of wetlands if not protective measures are taken. A 1-meter rise would have greater impact, inundating much of the Southern tip of Florida among other areas.
- Internationally, low-lying areas, such as parts of the Maldives and Bangladesh, would be completely inundated by a 1-meter sea level rise, creating large numbers of environmental refugees, which put stress on governments and social structures. 72 million people in China would be affected, assuming existing levels of coastal development.

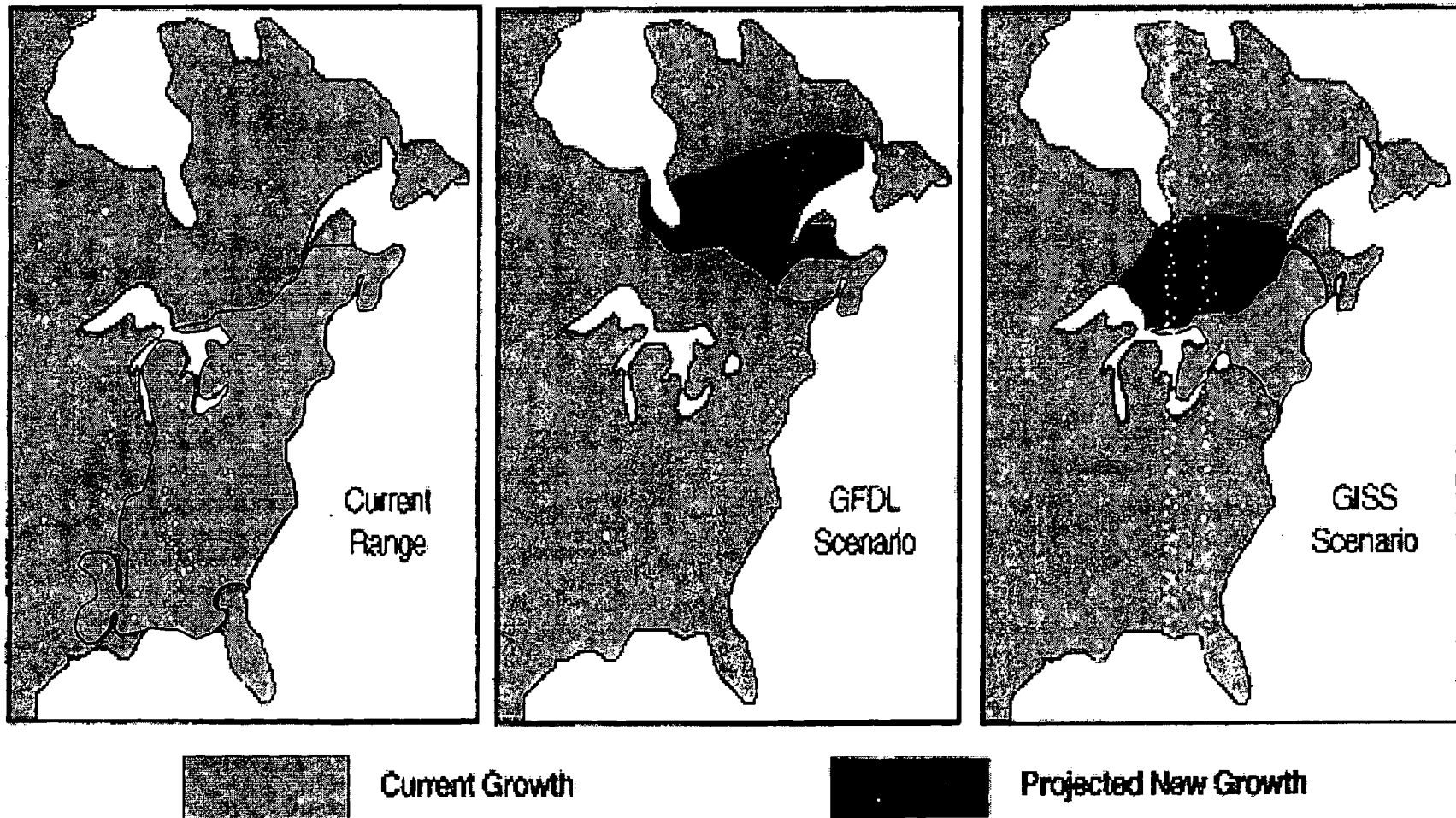
Agriculture and Food Supply: Agriculture is highly dependent on a number of variables that are likely to be affected by climate change, including weather patterns, longer term patterns of climate variability, and, most importantly, water availability. Climate strongly affects crop yields. Doubling of equivalent CO₂ are likely to lead to increased crop yields in many areas, but decreased yields in others, even for the same crop. The magnitude of these changes can exceed +/- 30 or 40 percent for some crops and locations. Despite these potentially large changes in yields, average global food production is not expected to change substantially. This is because farming practices are considered to be highly adaptable to different climates, because production of important food crops can shift to new locations in response to changes in climate, and because CO₂ has beneficial effects for plant photosynthesis and water use efficiency that can offset some deleterious effects of changes in climate. Impacts are likely to vary considerably across regions and some regions may suffer substantial reductions in agricultural production. In general, developing countries are more vulnerable to losses than are developed countries.

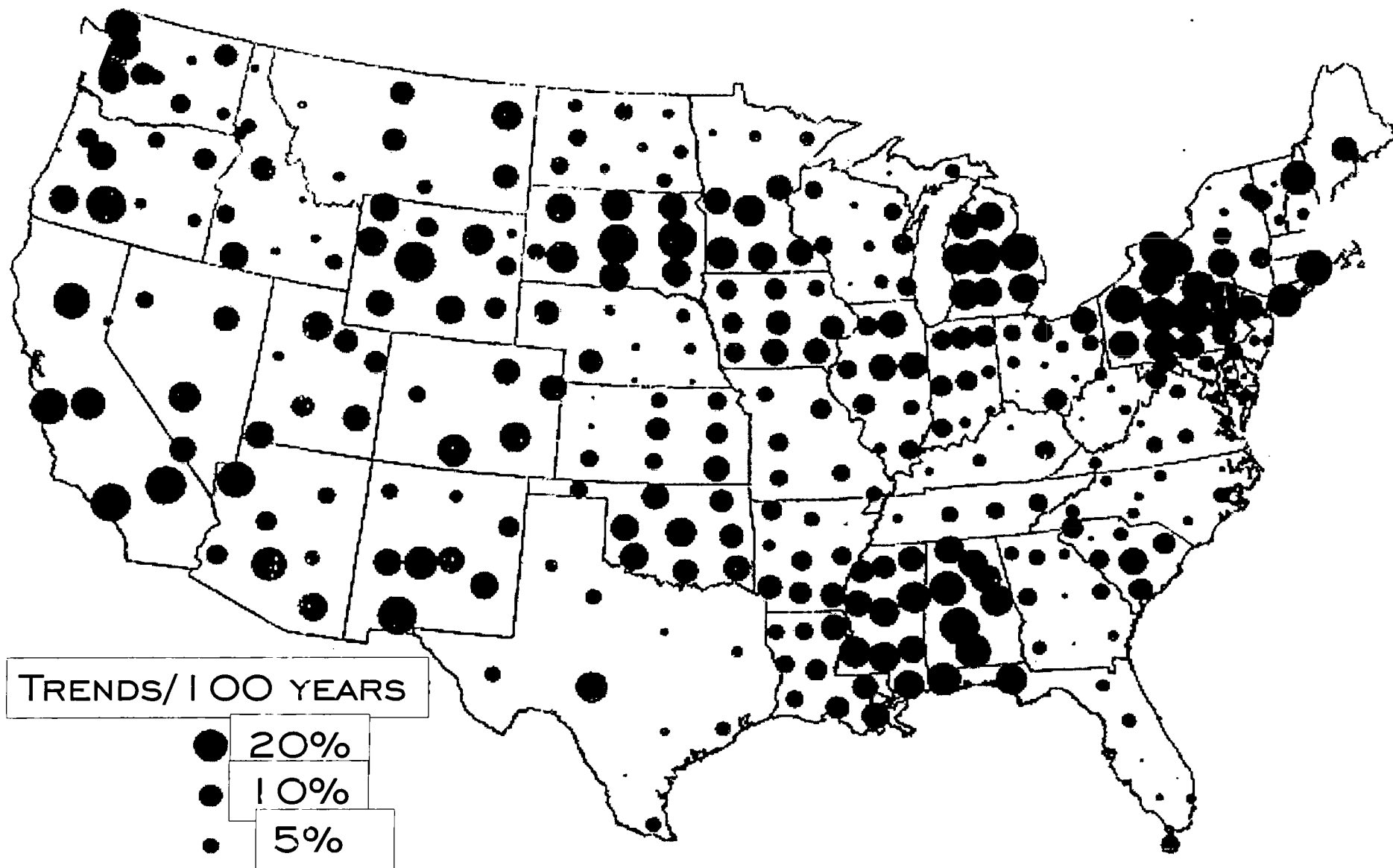
- Large reductions in soil moisture could significantly reduce flexibility in crop distribution and increase demands on water resources infrastructure.
- Increases in the range of pest habitat could increase vulnerabilities to pests and demand for, and use of, pesticides.
- In the United States, large areas of the eastern and central regions of the country face moderate to severe drying. Drought could become more frequent, particularly in the Great Plains.

Conclusion:

The rates of change already imposed on the climate system are the faster than any experienced during 10,000 years, during which modern civilization has developed. Current emissions trajectories, if not altered, could take us--before the end of the next century--a moment in history-- to an atmospheric concentration of CO₂ not seen on this planet during the last 50 million years. We cannot preclude some major positive feedback effects---the collapse of the West Antarctic ice sheet which would cause a 15 foot sea-level rise; the stopping of the ocean conveyor belt which could hurl Europe into a deep freeze, or the runaway melting of the Arctic which holds 5 to 7 orders of magnitude more carbon than is in the atmosphere today. While much work remains to be done to improve the precision of impact estimates, the increasingly apparent risk of the rapidly changing atmosphere argues that near-term mitigation and adaptation measures are warranted.

CURRENT AND PROJECTED RANGES OF BEECH TREES IN THE U.S. UNDER TWO MODEL SCENARIOS





Precipitation trends (1990-present, in percent of normal annual precipitation) within state climatic divisions. The diameter of the circle centered within each climatic division reflects the magnitude of the trend. Larger circles have the greater trends. Red reflects increasing precipitation and blue decreasing.

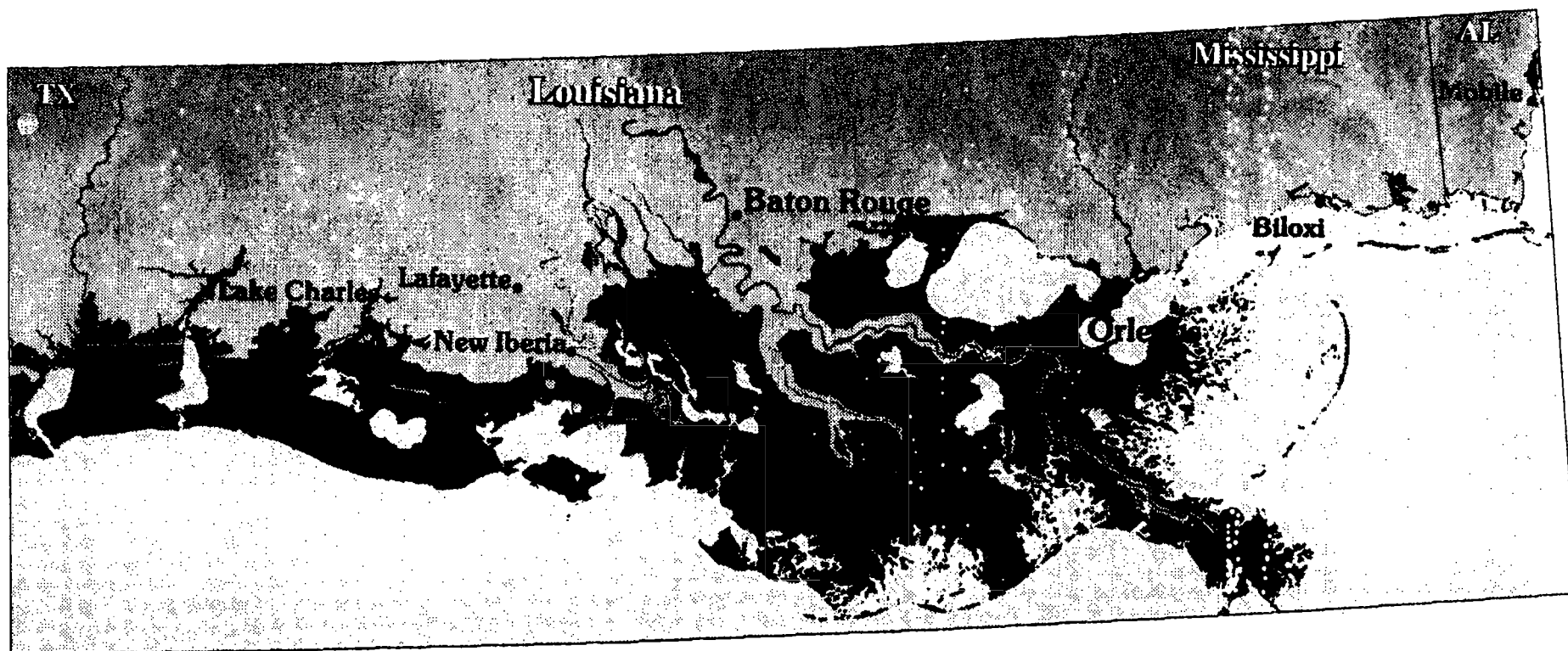
Palmer Drought Severity Index

(1987 through 1996)



Louisiana - Mississippi

Shoreline Change after a 1-Meter Rise in Sea Level



**Areas shown in red are
subject to inundation after
a 1-meter rise in sea level**

*TEST) many*Total Pages: 20

LRM ID: EHF335

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
Washington, D.C. 20503-0001

'97 NOV 4 AM 11:04

Tuesday, November 4, 1997

LEGISLATIVE REFERRAL MEMORANDUM

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FROM: Ronald K. Peterson (for) Assistant Director for Legislative Reference

OMB CONTACT: Robert J. Tuccillo *or Sarah Harrison 5-3534*
PHONE: (202)395-5809 FAX: (202)395-5836

SUBJECT: Office of Science and Technology Policy Oversight Testimony on The Science of Climate Change

DEADLINE: 12:00 NOON Tuesday, November 4, 1997

In accordance with OMB Circular A-19, OMB requests the views of your agency on the above subject before advising on its relationship to the program of the President. Please advise us if this item will affect direct spending or receipts for purposes of the "Pay-As-You-Go" provisions of Title XIII of the Omnibus Budget Reconciliation Act of 1990.

COMMENTS: Because the hearing is scheduled for 9:30 AM tomorrow, 11/5/97, if your agency does not provide comments by 12:00 Noon today, 11/4/97, this Office will assume that you have no objection to clearance.

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LRM ID: EHF335 **SUBJECT:** Office of Science and Technology Policy Oversight Testimony
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**RESPONSE TO
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You may also respond by:

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(2) sending us a memo or letter

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_____ Concur
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_____ FAX RETURN of _____ pages, attached to this response sheet

Bob T / OMB

Draft JHG Testimony, 11/3/97**Introduction**

Thank you for providing the opportunity to talk to you today about the costs of not acting to control climate change. I'll review the evidence for the changes in atmospheric composition that are occurring now, and the future changes we can expect if we don't take action to reduce emissions of greenhouse gases. I'll also discuss the implications of these changes for socio-economic and ecological systems.

Over the past decade, a series of global environmental changes have been documented in increasing detail. Not only have we demonstrated that climate change, the loss of biodiversity, stratospheric ozone depletion, alteration of the land surface, and changes in the nitrogen balance of the Earth's soils and waters are all occurring and changing the environment on a global-scale, we have also established beyond reasonable doubt that human activities are among the driving forces of such change. We recognize that these changes are interrelated, and that they form a suite of multiple stresses affecting people and the Earth's ecosystems.

The Current Situation

I find the scientific evidence for climate change compelling and this leads me to believe that we need to confront this growing challenge now. It is clear that emissions of greenhouse gases from human activities are enhancing the Earth's natural greenhouse effect, leading to a warming of the planet's surface. It is also clear that this warming will, in turn, lead to a series of further climate disruptions as sea-level rises, patterns of precipitation change, and ideal ranges for plants and animals shift significantly. Climate change is a long-term problem, and solving this problem will require a sustained, long-term effort.

The longer we continue "business as usual," the faster the rate of climate change, the greater the degree of warming, and the more severe the negative effects for human and ecological systems. The sooner we leave the "business as usual" path, the slower the rate of change, the more negative impacts we avoid and the more likely it is that natural systems will be able to adapt to change.

Climate change will force shifts in the range and distribution of many individual plant and animal species, and thus will alter many of the ecosystems, including forests and wetlands that provide the support systems for all life on Earth. If CO₂ concentrations double, fully 1/3 of the forest species worldwide are likely to shift type. In the U.S., sugar maples and beech trees may move completely into Canada, with considerable economic impact. The tourism, maple syrup production, and wood production which are so important to New England's livelihood are at risk. Species that cannot migrate fast or far enough may face extinction. We spend about \$3 billion dollars annually to maintain our parks and refuges as unique assemblages of plants and

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animals. Climate change threatens this substantial national investment. 1/3 of the Everglades may be inundated, 7,000 square miles of coastal lands may be lost, and 50% of recreational brown trout may be lost as waters warm too much to support them. Malaria mosquitoes may be able to survive year-round in much of the US, and drought may become more frequent even as total rainfall and extreme precipitation events increase. Functions such as flood control and purification of air and water can only be provided by intact ecological systems, and when those systems are disrupted or lost we lose the benefits they provide.

The potential cost of such disruption is very serious. A group of ecologists and economists (Costanza et al. in *Nature*) earlier this year produced the first dollar estimate of the value of global ecosystem services -- \$33 trillion annually, nearly twice the global gross national product. It is a conservative estimate based on equilibrium or marginal values -- values for small changes in services from their current values. In a world significantly warmer than today's many ecosystem services would be dearer to us than they are now.

Gretchen Dailey recently edited a book on "Nature's Services" -- not an attempt at comprehensive valuation but, rather, a compilation of efforts to identify and characterize components of ecosystem service value. Her conclusions were: "First, the services operate in intricate and little-explored ways that would be very difficult to substitute for using technology. Their marginal value will therefore almost certainly only go up as their supply dwindles. Second, the total value of ecosystem services is very large. The services examined in this volume amount to many trillions of dollars annually. Third, marginal values of ecosystem services appear high in areas where we have an indication of them. Loss of soil, pest control, pollinators, and ecosystem goods are all presently impoverishing local or regional groups of people. Finally, safeguarding ecosystem services represents one of the wisest economic investments society could make"

Clearly environmental damages from global warming will increase production costs in affected industries and raise the cost of living for us all. Increased evapotranspiration may reduce crop yields and water availability, raising agricultural costs. Agricultural pests and diseases may increase. Higher temperatures may raise air conditioning and cooling costs (though lowering heating bills). Coastal flooding and storm damages may increase due to rising sea levels. The most recent summary of economic impacts of climate change (by Repetto and others at WRI) cites estimates of production losses from a doubling of CO2 concentrations of 1 or 2 percent of GDP. A survey of experts by Bill Nordhaus in 1994 showed a large variation in estimated economic impacts of climate change but unanimity on the point that damage costs increase as the magnitude of climate change increases. The longer we wait to act, the larger that increase will be.

For ecosystems, the rate of change may be even more significant than its eventual magnitude. As the distinguished ecologist Professor Jane Lubchenco told the President earlier this year: "The slower the rate of change in climate, the less catastrophic the results. Species are

more likely to be able to migrate, to grow, and evolve if the rate of change is slow." The sooner we reduce emissions, the slower the rate of climate change we can expect.

The Framework Convention on Climate Change, to which the United States is a party, seeks to stabilize atmospheric concentrations at levels that "prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to: (i) allow ecosystems to adapt naturally to climate change; (ii) ensure that food production is not threatened; and (iii) enable economic development to proceed in a sustainable manner." One could argue that the rates of change are already outside that range. Even if emissions were frozen at today's levels, temperatures would rise at about 2 degrees F per century because concentrations would continue to rise. The historical pollen record shows that this rate is about the most that ecosystems could possibly keep up with.

We have already increased atmospheric concentrations of CO₂ thirty percent since the onset of the industrial revolution. To stop at an atmospheric concentration of 550 ppmv of CO₂, which represents about a doubling of pre-industrial levels, reductions in the growth rate of worldwide annual emissions must begin by 2013. That is, the whole world must begin to "apply the brakes" within the next 2 decades, and world emissions must begin declining steeply during the second quarter of the next century.

The results that give us cause for concern come from numerous studies of past climate change, from observations of ecosystems changing over time, and from model simulations that project future conditions. An important aspect of interpreting such results, especially model simulations, is accounting for uncertainty, which is often done in a very selective way by climate change skeptics. Uncertainty cuts both ways: outcomes could be less dramatic than expected based on our current understanding, but could just as well be more severe. We must remember that the current generation of impact projections is focused on a limited number of variables, and that this may result in an overly benign picture of the future. For instance, a series of projections that includes carbon dioxide increases, temperature change, and precipitation changes now indicate that there might be no net effect on global agricultural productivity, although regional dislocations are expected, with the poorest countries experiencing the greatest losses. However, these analyses do not include potential water constraints or changes in the distribution of pests. As the scientists told us at the White House conference October 6, the impacts we have not been able to include are more likely to make the results worse rather than better.

We have not examined the ecological consequences of climate change beyond a doubling of today's concentrations. Yet, if we continue on a "business as usual" path, the Earth's concentrations will soar through that on their way toward a tripling or quadrupling of pre-industrial levels. We will take the planet to levels that have not been seen for 50 million years in a single century, a geological blink of an eye. The Administration has received letters signed by thousands of scientists in the last few months urging action on this issue--warning that nonlinearities or unexpected catastrophic events such as the ozone hole are likely when the rates of change are so fast.